USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with United States Department of Agriculture, Forest Service, and the South Dakota Agricultural Experiment Station

Soil Survey of Jones County, South Dakota

How To Use This Soil Survey

General Soil Map

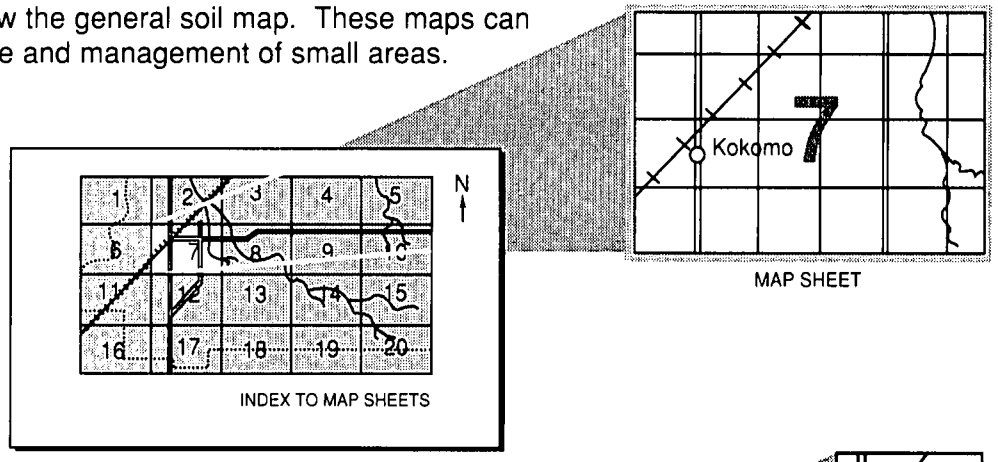
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

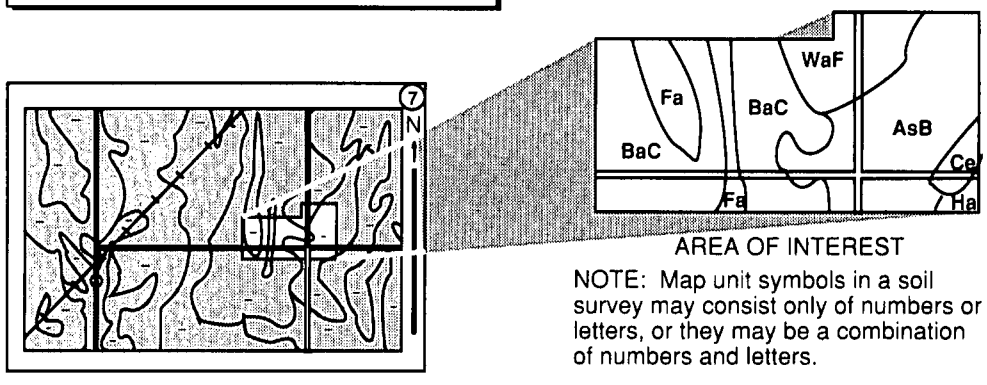
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major field work for this soil survey was completed in 1990. Soil names and descriptions were approved in 1990. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the United States Department of Agriculture, Natural Resources Conservation Service, and Forest Service; and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Jones County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: In the background, Nimbro soils on the flood plain of the Bad River are used for cropland and tame pasture and hay. The area of Sansarc soils in the foreground is used as rangeland.

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Issued 1999

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Jones County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for optimum food and fiber production while protecting our soil, water, air, plants, and animal resources. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the South Dakota Cooperative Extension Service.

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Soil Survey of
Jones County, South Dakota

By Allen A. Faulkner, Natural Resources Conservation Service

Soils surveyed by Allen A. Faulkner, Kenneth J. Heil, and David M. Rocklitz,
Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
United States Department of Agriculture, Forest Service, and the South Dakota
Agricultural Experiment Station

JONES COUNTY is in the central part of South Dakota (fig. 1). It has a total land area of 621,734 acres, which includes about 4,919 acres of water. About 19,950 acres is administered by the United States Department of Agriculture, Forest Service.

General Nature of the County

This section gives general information concerning the county. It describes climate; physiography, relief, and drainage; settlement; ranching and farming; and natural resources.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Murdo, South Dakota in the period 1948 to 1994. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season. Data in tables 2 and 3 were recorded at Murdo, South Dakota in the period 1951 to 1987.

In winter, the average temperature is 22 degrees F and the average daily minimum temperature is 11 degrees. The lowest temperature on record, which occurred at Murdo on January 29, 1966, is -31 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred at Murdo on July 10, 1966, is 112 degrees.

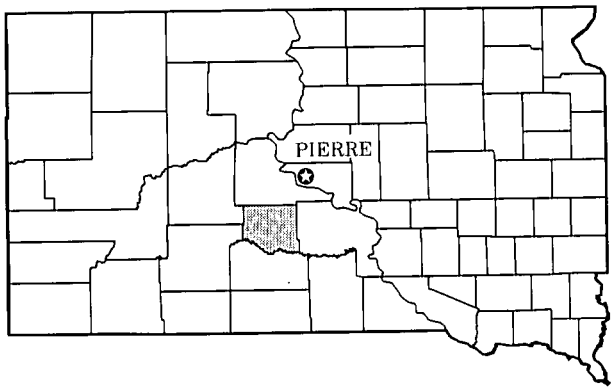

Figure 1.—Location of Jones County in South Dakota.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 18 inches. Of this, 14 inches, or 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The

heaviest 1-day rainfall during the period of record was 3.02 inches at Murdo on June 19, 1979. Thunderstorms occur on about 42 days each year. During thunderstorms in summer hail occurs in small, scattered areas.

The average seasonal snowfall is 31 inches. The greatest snow depth at any one time during the period of record was 29 inches. On the average, 22 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. Several times each winter, storms with snow and high wind bring blizzard conditions to the area.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the north-northwest. Average wind speed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

Jones County is within the Pierre Hills region in the Missouri Plateau section of the Great Plains Physiographic Division *(7)*.

The Pierre Hills generally are gently sloping to strongly sloping, but they are steep in areas along the Bad River, the White River, and major drainageways. The Bad River flows through the northwestern corner of the county. It flows during snowmelt in spring and after significant rainfall events. The White River forms the southern border of the county and flows throughout the year. Most of the major drainageways of the county flow north or south into one of these rivers.

Elevations range from about 1,655 feet above sea level along the Bad River to 2,516 feet on White Clay Butte northeast of Murdo.

Settlement

Jones County was formed by the vote of the people in 1916. It was formerly part of Lyman County and is the last county formed in the State. It was named after Jones County, Iowa *(3)*.

The Sioux Indians were early inhabitants of the area that is now Jones County. French fur traders appeared around the turn of the nineteenth century. The area was first opened to settlers on February 10, 1890 through provisions of the Homestead Law *(3)*. The first area to be settled was the flood plain adjacent to the White River (fig. 2).

The greatest influx of settlers occurred between 1904 and 1910. Settlement was enhanced in 1906 when the Chicago, Milwaukee, St. Paul, and Pacific Railroad reached Murdo and the Chicago and Northwestern Railroad reached Capa.

The population of Jones County was 2,933 in 1939 *(4)*. It declined to 1,882 in 1970, 1,463 in 1980, and 1,324 in 1990 *(12)*. Murdo, with a population of 679 in 1990, is the county seat and largest town in the county. Other present-day communities are Draper and Okaton. Former communities, such as Capa and Van Metre, are also in the county.

The Chicago, Milwaukee, St. Paul, and Pacific Railroad served the county until 1980. In July 1988, the Dakota Southern Railroad Company began operating the line under lease from the State of South Dakota. The Chicago and Northwestern Railroad operated until it was purchased by the Dakota, Minnesota, and Eastern Railroad in September 1986. U.S. Highway 83 and Interstate Highway 90 are the main transportation routes. Most rural areas are served by gravel roads. Murdo has a small airport. A few small private landing strips are scattered throughout the county.

Ranching and Farming

Ranching is the principal enterprise in Jones County. Beef cattle and sheep are the main livestock. About 80 percent of farm income is derived from the sale of livestock and livestock products *(13)*. Many of the crops are used for livestock feed. Most of the small grain is sold as a cash crop.

In 1992, the county had 196 ranches and farms, which averaged about 2,951 acres in size *(13)*. The trend is toward fewer and larger ranches and farms. Many ranchers lease additional grazingland from the U.S. Forest Service.

About 57 percent of the acreage is rangeland, and about 41 percent is used for cultivated crops and tame pasture and hay *(11)*. Winter wheat, grain sorghum, forage sorghum, spring wheat, oats, and alfalfa are the main crops. In 1993, winter wheat was planted on about 58,400 acres, grain sorghum on about 7,000 acres, oats on about 3,500 acres, and spring wheat on about 1,000 acres *(6)*. Barley, corn, and sunflowers also are grown. Alfalfa, crested wheatgrass, and intermediate wheatgrass are the main crops grown for tame pasture and hay.

The Jones County Soil Conservation District was organized in 1955. It has been instrumental in planting grasses and trees to help control erosion. The trees also provide protection for farmsteads and wildlife.

Figure 2.—The White River was influential in the early settlement of Jones County. Lakoma silty clay, 6 to 15 percent slopes, is in the foreground, and Bigbend silty clay loam is on the flood plain.

Natural Resources

Soil is the most important natural resource in Jones County. It provides a growing medium for crops and for the grasses grazed by livestock. Other natural resources are water, sand and gravel, and wildlife.

The main sources of water for livestock are stock water impoundments and wells. Water quantity generally is greater in the deep wells, but the quality is poor because of a high content of soluble salts. Shallow wells also provide domestic water in some areas. The Bad River and the White River are sources of water for livestock, wildlife, and irrigation. The White River is perennial, but all of the other drainageways flow intermittently and provide water only during periods of snowmelt or high rainfall. Dugouts in areas of Hoven and Kolls soils provide additional water for livestock and wildlife.

Small deposits of sand and gravel are widely scattered throughout the central and western parts of the county. They are on remnants of ancient terraces and on the flood plain of the White River. They range from a few inches to 7 or 8 feet thick but generally are about 3 feet thick. Because they have an excessive amount of fine rock fragments, such as shale, the sand and gravel are unsuitable as concrete aggregate or as construction material. They are suitable, however, as subgrade material for roads.

The chief wildlife resources in Jones County are antelope, white-tailed deer, mule deer, pheasant, gray partridge, sharp-tailed grouse, and prairie chicken. Coyote, fox, and raccoon are the main predators. Many stock water impoundments provide bass, bluegill, northern pike, trout, crappies, and perch for fishing. Catfish are in the Bad River and the White River.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a

description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes.

Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils. As much as 5 acres of an included soil can be in an area with the major soil before it is delineated.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas of as much as 5 acres in size and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soils occur on different landform positions (fig. 3). These different landform positions affect such characteristics as the amount of topsoil, the drainage classes, the runoff rate, and the content of organic matter.

The twelve associations in this county have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. The names of the associations do not coincide exactly with those on the general soil maps in the published surveys of Haakon, Jackson, Lyman, and Stanley Counties. Differences are the result of variations in the design and composition of the map units, variability within the physiographic area, or changes and refinements in series concepts.

Soil Descriptions

Level to Gently Sloping, Loamy and Clayey Soils on Flood Plains, Terraces, and Fans

These soils are dominantly level but are nearly level to gently sloping in some places. They make up about 5 percent of the county. About 55 percent of the acreage is rangeland and is used for grazing or hay.

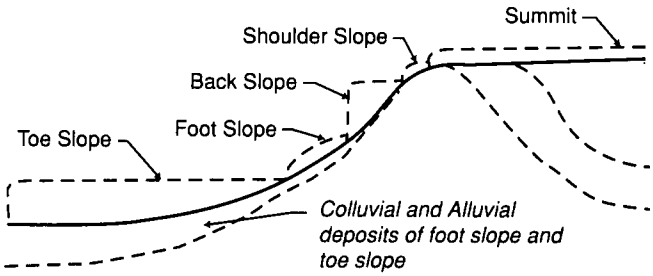

Figure 3.—Landform positions.

The rest is mainly used as cropland and is used for forage or cash crops. Maintaining the most productive grasses is the main management concern affecting rangeland. Alfalfa, forage sorghum, grain sorghum, winter wheat, oats, and corn are the main crops. Conserving moisture, controlling wind erosion, and the slow water intake rate are the main management concerns affecting cultivated areas.

1. Nimbro-Bullcreek-Wendte Association

Very deep, well drained and moderately well drained, level to gently sloping, loamy and clayey soils on flood plains, fans, and terraces

This association is along the Bad River. It is dissected by many deep, intermittent drainageways. The soils formed in alluvium. Slopes are slightly concave or smooth in areas of the Bullcreek soils and are nearly level in areas of the Nimbro and Wendte soils.

This association makes up about 3 percent of the county. It is about 55 percent Nimbro soils, 30 percent Bullcreek soils, 10 percent Wendte soils, and 5 percent minor soils.

The well drained Nimbro soils are on high and low flood plains. Slopes are 0 to 1 percent. Typically, the surface layer is grayish brown, calcareous silty clay loam. The underlying material is light brownish gray, calcareous, stratified clay loam.

The well drained Bullcreek soils are on foot slopes on fans and terraces. Slopes range from 0 to 6

percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown, very firm clay. The underlying material is grayish brown and light brownish gray clay. The lower part of the subsoil and the underlying material are calcareous and contain salts.

The moderately well drained Wendte soils are on high flood plains. Slopes are 0 to 1 percent. Typically, the surface layer is grayish brown, calcareous silty clay. The underlying material is grayish brown and light brownish gray, calcareous, stratified clay loam.

Minor in this association are Albaton, Bigbend, Hilmoe, Promise, and Sansarc soils; areas of Rock outcrop; and Slickspots. The very poorly drained Albaton soils are on low flood plains. The well drained Bigbend and moderately well drained Hilmoe soils are in similar landscape positions to those of the Nimbro and Wendte soils. The well drained Promise soils are on the lower back slopes and on foot slopes above the Bullcreek soils. The shallow Sansarc soils are on shoulder slopes and the upper back slopes. The areas of Rock outcrop are on the very steep back slopes adjacent to the Bad River and the major streams that drain into it. The moderately well drained Slickspots are on the lower foot slopes below the Bullcreek soils.

About 80 percent of this association is used as rangeland. Maintaining the most productive grasses is the main management concern affecting rangeland. The major soils are suited to rangeland and to rangeland wildlife habitat. Deciduous trees and shrubs along the Bad River provide protection for livestock and wildlife. The Nimbro and Wendte soils are suited to cultivated crops and to tame pasture and hay. The Bullcreek soils generally are unsuited to cultivated crops because of the dense clay subsoil, a low available water capacity, and the high concentration of salt. Most of the cropland is in areas of the Nimbro and Wendte soils. Alfalfa, forage sorghum, and winter wheat are the main crops. Conserving moisture and controlling wind erosion are the main management concerns affecting cultivated areas. The slow water intake rate in the Bullcreek and Wendte soils also is a management concern.

2. Bigbend-Hilmoe Association

Very deep, well drained and moderately well drained, level, loamy and clayey soils on flood plains

This association is along the White River. The soils formed in alluvium. Slopes are long and smooth. The soils are subject to flooding when ice dams the river and after intense rainfall. The flooding generally is of short duration. Oxbows and abandoned river channels are ponded after flooding and intense rainfall.

This association makes up about 2 percent of the county. It is about 65 percent Bigbend soils, 20 percent Hilmoe soils, and 15 percent minor soils (fig. 4).

The loamy, well drained Bigbend soils are on high and low flood plains. Slopes are 0 to 1 percent. Typically, the surface layer is light grayish brown, calcareous silt loam. The underlying material is light gray, calcareous very fine sandy loam.

The clayey, moderately well drained Hilmoe soils are on high flood plains. Slopes are 0 to 1 percent. Typically, the surface layer is grayish brown, calcareous silty clay. The underlying material is light brownish gray, calcareous silty clay in the upper part and light gray, stratified, calcareous silt loam in the lower part.

Minor in this association are Albaton, Bullcreek, Inavale, and Wendte soils. The very poorly drained Albaton soils are on low flood plains. The dense Bullcreek soils are on foot slopes of the adjacent uplands. The excessively drained, sandy Inavale soils are on high flood plains adjacent to the White River. The moderately well drained Wendte soils are clayey throughout. The Inavale and Wendte soils are in similar landscape positions to those of the Bigbend and Hilmoe soils.

About 65 percent of this association is cropland. The rest is mainly used as rangeland and is used for grazing or hay. The major soils are suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Some areas are irrigated. Conserving moisture, controlling wind erosion, and the high content of lime are the main management concerns affecting cultivated areas. Alfalfa, forage sorghum, grain sorghum, winter wheat, oats, and corn are the main crops. A small acreage of sunflowers is also grown. Maintaining the most productive grasses is the main management concern affecting rangeland. Deciduous trees and shrubs along the White River provide protection for livestock and wildlife.

Nearly Level to Moderately Sloping, Clayey and Loamy Soils on Plains

These soils dominantly are nearly level to gently sloping but are moderately sloping along some of the drainageways. They make up about 7 percent of the county. About 85 percent of the acreage is cropland. Winter wheat, grain sorghum, corn, oats, and alfalfa are the main crops. Controlling erosion, conserving moisture, and the slow water intake rate are the main management concerns affecting cultivated areas.

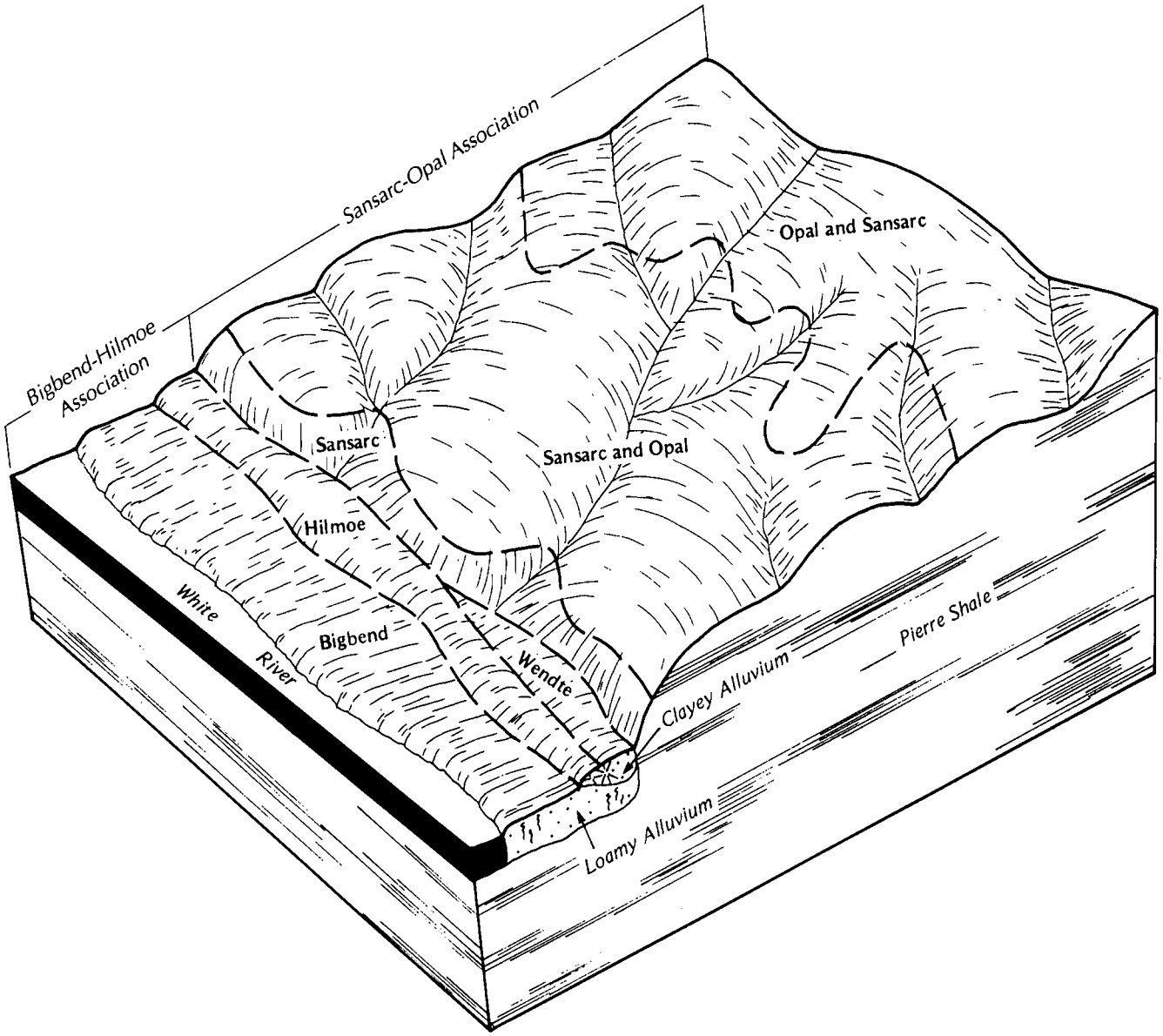

Figure 4.—Typical pattern of soils and parent material in the Bigbend-Hilmoe and Sansarc-Opal associations.

3. Promise Association

Deep and very deep, well drained, nearly level to moderately sloping, clayey soils on plains

This association is characterized by broad flats and shallow drainageways on soils formed in clayey residuum of shale. Slopes are long and smooth. The drainage pattern is poorly defined, but narrow, meandering stream channels are in some areas.

This association makes up about 3 percent of the county. It is about 80 percent Promise soils and 20 percent minor soils (fig. 5).

Promise soils are on the lower back slopes and on foot slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous clay. The subsoil is dark grayish brown and grayish brown, calcareous clay. The underlying material is grayish brown, calcareous clay.

Minor in this association are Bullcreek, Capa, Kolls, Lakoma, Opal, and Witten soils. The dense Bullcreek soils are on foot slopes on fans or terraces below the Promise soils. The moderately well drained, sodium-affected Capa soils are on foot slopes. The poorly drained and very poorly drained Kolls soils are in

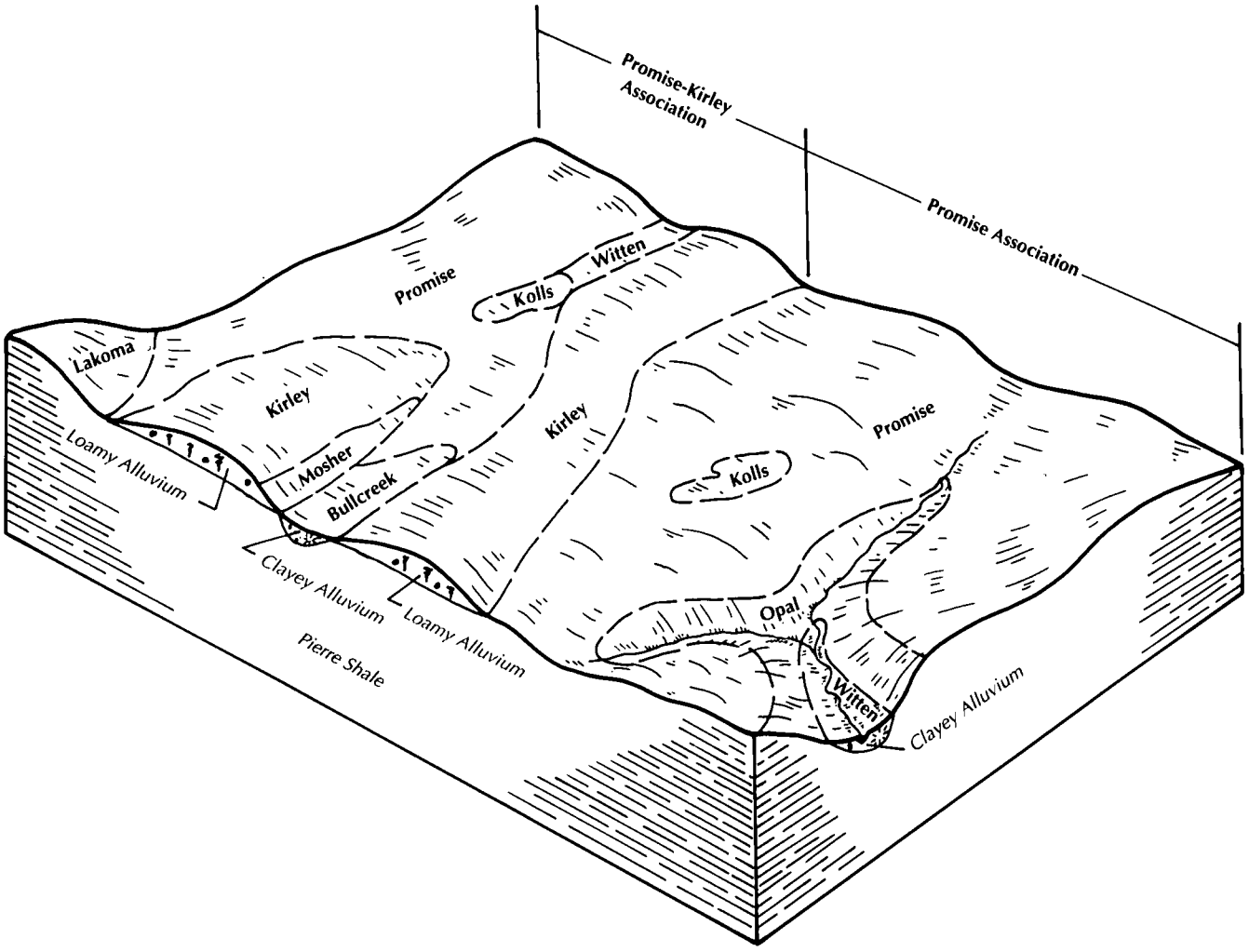

Figure 5.—Typical pattern of soils and parent material in the Promise-Kirley and Promise associations.

basins. The moderately deep Lakoma and Opal soils are on back slopes. The moderately well drained Witten soils are on foot slopes.

About 85 percent of this association is cropland. The steeper areas along drainageways and the larger basins support native grasses and are used for grazing or hay. The major soil is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Winter wheat, grain sorghum, oats, and alfalfa are the main crops. Controlling erosion, conserving moisture, and the slow water intake rate are the main management concerns affecting cultivated areas. Maintaining the most productive grasses is the main management concern affecting rangeland.

4. Millboro Association

Very deep, well drained, nearly level to moderately sloping, loamy soils on plains

This association is characterized by gently sloping areas interrupted by low ridges and entrenched drainageways on soils formed in clayey residuum of shale. Slopes dominantly are nearly level and gently sloping but are moderately sloping in some areas. The drainage pattern is well defined in most areas but is poorly defined in areas where drainageways terminate in small basins.

This association makes up about 4 percent of the county. It is about 80 percent Millboro soils and 20 percent minor soils.

Millboro soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray and dark grayish brown, calcareous silty clay loam. The subsoil and the underlying material are grayish brown, calcareous silty clay.

Minor in this association are Bullcreek, Kolls, Lakoma, Promise, and Witten soils. The dense Bullcreek soils are on foot slopes. The poorly drained and very poorly drained Kolls soils are in basins. The moderately deep Lakoma soils are on summits and the upper back slopes. The well drained Promise and moderately well drained Witten soils are on foot slopes.

About 85 percent of this association is cropland. The rest is mainly used as rangeland and is used for grazing or hay. The major soil is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Winter wheat, grain sorghum, corn, oats, and alfalfa are the main crops. Controlling erosion, conserving moisture, the high content of lime, and the slow water intake rate are the main management concerns affecting cultivated areas. Maintaining the most productive grasses is the main management concern affecting rangeland.

Nearly Level to Gently Rolling, Clayey and Loamy Soils on Plains and Terraces

These soils dominantly are nearly level to gently sloping but are gently rolling in some places. They make up about 22 percent of the county. About 65 percent of the acreage is cropland. The rest is mainly used as rangeland and is used for grazing or hay. Winter wheat, grain sorghum, oats, and alfalfa are the main crops. Controlling erosion and conserving moisture are the main management concerns affecting cultivated areas. The slow water intake rate is also a management concern in areas of the Promise soils.

5. Promise-Kirley Association

Deep and very deep, well drained, nearly level to gently sloping, clayey and loamy soils on plains and terraces

This association is on plains and on high terraces. The soils on plains formed in clayey residuum of shale, and the soils on high terraces formed in alluvium. This association is characterized by broad, nearly level terraces separated by gently sloping ridges. The steeper slopes occur along entrenched drainageways. The drainage pattern is poorly defined in most areas where drainageways terminate in basins. It is well defined along the major drainageways.

This association makes up about 8 percent of the county. It is about 40 percent Promise soils, 38 percent Kirley soils, and 22 percent minor soils (fig. 5).

The clayey Promise soils are on smooth or slightly convex foot slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown, calcareous clay. The subsoil is dark grayish brown and grayish brown, calcareous clay. The underlying material is grayish brown, calcareous clay.

The loamy Kirley soils are on summits, shoulder slopes, and smooth back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray clay loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay and clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

Minor in this association are Bullcreek, Capa, Kolls, Lakoma, Mosher, and Witten soils. The dense Bullcreek soils are on foot slopes below the Promise soils. The sodium-affected Capa and Mosher soils are on the lower foot slopes. The poorly drained and very poorly drained Kolls soils are in basins. The moderately deep Lakoma soils are on back slopes. The moderately well drained Witten soils are also on foot slopes.

About 70 percent of this association is cropland. The rest is mainly used as rangeland and is used for grazing or hay. The major soils are suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Winter wheat, grain sorghum, oats, and alfalfa are the main crops. Controlling erosion and conserving moisture are the main management concerns affecting cultivated areas. The slow water intake rate in areas of the Promise soils is also a management concern. Maintaining the most productive grasses is the main management concern affecting rangeland.

6. Kirley-Mosher Association

Very deep, well drained and moderately well drained, nearly level to moderately sloping, loamy soils on terraces

This association is on high terraces characterized by long, smooth or slightly convex slopes and numerous small swales. The soils formed in alluvium. Slopes dominantly are nearly level or gently undulating but are moderately sloping in some areas. The drainage pattern is poorly defined in most areas where drainageways terminate in basins.

This association makes up about 6 percent of the county. It is about 42 percent Kirley soils, 33 percent Mosher soils, and 25 percent minor soils.

The well drained Kirley soils are on summits and back slopes. In this association they generally have

slopes of 0 to 9 percent. Typically, the surface layer is dark gray clay loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay and clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

The moderately well drained, sodium-affected Mosher soils are on foot slopes. Slopes range from 0 to 2 percent. Typically, the surface layer is gray silt loam. The subsurface layer is light gray silt loam. The subsoil is dark grayish brown and grayish brown clay. It is calcareous in the lower part. The underlying material is grayish brown, calcareous silty clay.

Minor in this association are Hoven, Kolls, Lakoma, Okaton, Promise, and Witten soils. The poorly drained Hoven and poorly drained and very poorly drained Kolls soils are in basins. The moderately deep Lakoma soils are on back slopes. The shallow Okaton soils are on shoulder slopes and the upper back slopes. The clayey Promise soils are on the lower back slopes and on foot slopes. The moderately well drained Witten soils are on foot slopes.

About 50 percent of this association is cropland. The rest is mainly used as rangeland and is used for grazing or hay. The major soils are suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Winter wheat, grain sorghum, oats, and alfalfa are the main crops. Controlling erosion, conserving moisture, and the slow water intake rate in areas of the Mosher soils are the main management concerns affecting cultivated areas. Maintaining the most productive grasses is the main management concern affecting rangeland.

7. Kirley Association

Very deep, well drained, nearly level to gently rolling, loamy soils on terraces

This association is on high terraces characterized by long, smooth slopes that have numerous swales and small basins. The soils formed in alluvium. Slopes dominantly are nearly level but are gently undulating to gently rolling in some areas. The drainage pattern is poorly defined in most areas where drainageways terminate in basins.

This association makes up about 8 percent of the county. It is about 80 percent Kirley soils and 20 percent minor soils.

Kirley soils are on summits, shoulder slopes, and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray clay loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay and clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

Minor in this association are Kolls, Lakoma, Mosher, Ree, and Vivian soils. The poorly drained and very poorly drained Kolls soils are in basins. The moderately deep Lakoma soils are on back slopes above the Kirley soils. The moderately well drained, sodium-affected Mosher soils are on foot slopes. The loamy Ree soils are in similar landscape positions to those of the Kirley soils. The gravelly Vivian soils are on summits and shoulder slopes.

About 70 percent of this association is cropland. The rest is mainly used as rangeland and is used for grazing or hay. The major soil is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Winter wheat, grain sorghum, oats, and alfalfa are the main crops. Controlling erosion and conserving moisture are the main management concerns affecting cultivated areas. Maintaining the most productive grasses is the main management concern affecting rangeland.

Gently Sloping to Very Steep, Clayey Soils on Dissected Plains

These soils dominantly are moderately sloping or steep but are gently sloping to very steep in some areas. They make up about 62 percent of the county. About 85 percent of the acreage is rangeland. Maintaining plant vigor, controlling water erosion, and preventing the formation of gullies along cattle trails are the main management concerns affecting rangeland.

8. Lakoma-Okaton Association

Moderately deep and shallow, well drained, moderately sloping to steep, clayey soils on dissected plains

This association is on dissected plains. The soils formed in clayey residuum of shale. Slopes generally are moderately sloping or strongly sloping but are steep in some areas. The drainage pattern is well defined.

This association makes up about 19 percent of the county. It is about 60 percent Lakoma soils, 25 percent Okaton soils, and 15 percent minor soils.

The moderately deep Lakoma soils are on summits and back slopes. Slopes range from 6 to 25 percent. Typically, the surface layer is dark grayish brown, calcareous silty clay. The subsoil and the underlying material are grayish brown and light brownish gray, calcareous silty clay. Pale yellow, calcareous shale is at a depth of about 36 inches.

The shallow Okaton soils are on shoulder slopes and back slopes along drainageways. Slopes range from 15 to 40 percent. Typically, the surface layer is grayish brown, calcareous silty clay. The transitional layer and the underlying material are grayish brown, calcareous silty clay and clay. Grayish brown and light brownish gray, calcareous shale is at a depth of about 14 inches.

Minor in this association are Bullcreek, Herdcamp, Kirley, Promise, and Vivian soils. The dense Bullcreek soils are on foot slopes on terraces and fans below the Lakoma soils. The very poorly drained Herdcamp soils are on low flood plains. The loamy Kirley soils are on summits and back slopes above the Okaton soils. The deep and very deep Promise soils are on the lower back slopes and foot slopes below the Lakoma soils. The gravelly Vivian soils are on summits and shoulder slopes.

About 85 percent of this association is rangeland. Maintaining plant vigor, controlling water erosion, and preventing the formation of gullies along cattle trails are the main management concerns affecting rangeland. The major soils are suited to rangeland and to rangeland wildlife habitat. The less sloping areas of the Lakoma soils and some areas of the minor soils are suited to cultivated crops and to tame pasture and hay, but the shallow depth to bedrock and the slope of the Okaton soils are limitations. Winter wheat, grain sorghum, forage sorghum, and alfalfa are the main crops. Conserving moisture, controlling erosion, and the slow water intake rate are the main management concerns affecting cultivated areas.

9. Okaton-Lakoma Association

Shallow and moderately deep, well drained, moderately sloping to very steep, clayey soils on dissected plains

This association is characterized by ridges and entrenched drainageways. The soils formed in clayey residuum of shale. Slopes generally are strongly sloping to steep but are moderately sloping in some areas and very steep in other areas. The drainage pattern is well defined.

This association makes up about 18 percent of the county. It is about 50 percent Okaton soils, 35 percent Lakoma soils, and 15 percent minor soils (fig. 6).

The shallow Okaton soils are on shoulder slopes and back slopes along drainageways. Slopes range from 15 to 60 percent. Typically, the surface layer is grayish brown, calcareous silty clay. The transitional layer and the underlying material are grayish brown, calcareous silty clay and clay. Grayish brown and light brownish gray, calcareous shale is at a depth of about 14 inches.

The moderately deep Lakoma soils are on summits and back slopes. Slopes range from 6 to 25 percent. Typically, the surface layer is dark grayish brown, calcareous silty clay. The subsoil and the underlying material are grayish brown and light brownish gray, calcareous silty clay. Pale yellow, calcareous shale is at a depth of about 36 inches.

Minor in this association are Bullcreek, Herdcamp, Sansarc, Vivian, and Wendte soils. The dense Bullcreek soils are on foot slopes on terraces and alluvial fans below the Lakoma soils. The very poorly drained Herdcamp soils are on low flood plains. The shallow Sansarc soils are on shoulder slopes and back slopes adjacent to major drainageways. The gravelly Vivian soils are on summits and shoulder slopes. The moderately well drained, stratified Wendte soils are on high flood plains.

Nearly all of this association is rangeland. Maintaining plant vigor, controlling water erosion, and preventing the formation of gullies along cattle trails are the main management concerns affecting rangeland. The major soils are suited to rangeland and to rangeland wildlife habitat. They are not suited to cultivated crops and tame pasture and hay because of the slope and the shallow depth to bedrock.

10. Opal-Sansarc Association

Moderately deep and shallow, well drained, gently sloping to steep, clayey soils on dissected plains

This association is characterized by low ridges and entrenched drainageways. The soils formed in clayey residuum of shale. Slopes generally are moderately sloping or strongly sloping but are steep in some areas. The drainage pattern is well defined.

This association makes up about 19 percent of the county. It is about 75 percent Opal soils, 15 percent Sansarc soils, and 10 percent minor soils.

The moderately deep Opal soils are on summits and back slopes. Slopes range from 3 to 25 percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown and light brownish gray, calcareous clay. The underlying material is light brownish gray, calcareous clay that has masses of gypsum and other salts. Light brownish gray and dark gray shale is at a depth of about 35 inches.

The shallow Sansarc soils are on shoulder slopes and back slopes along drainageways. Slopes range from 9 to 40 percent. Typically, the surface layer and the transitional layer are olive gray, calcareous clay. The underlying material is light olive gray, calcareous

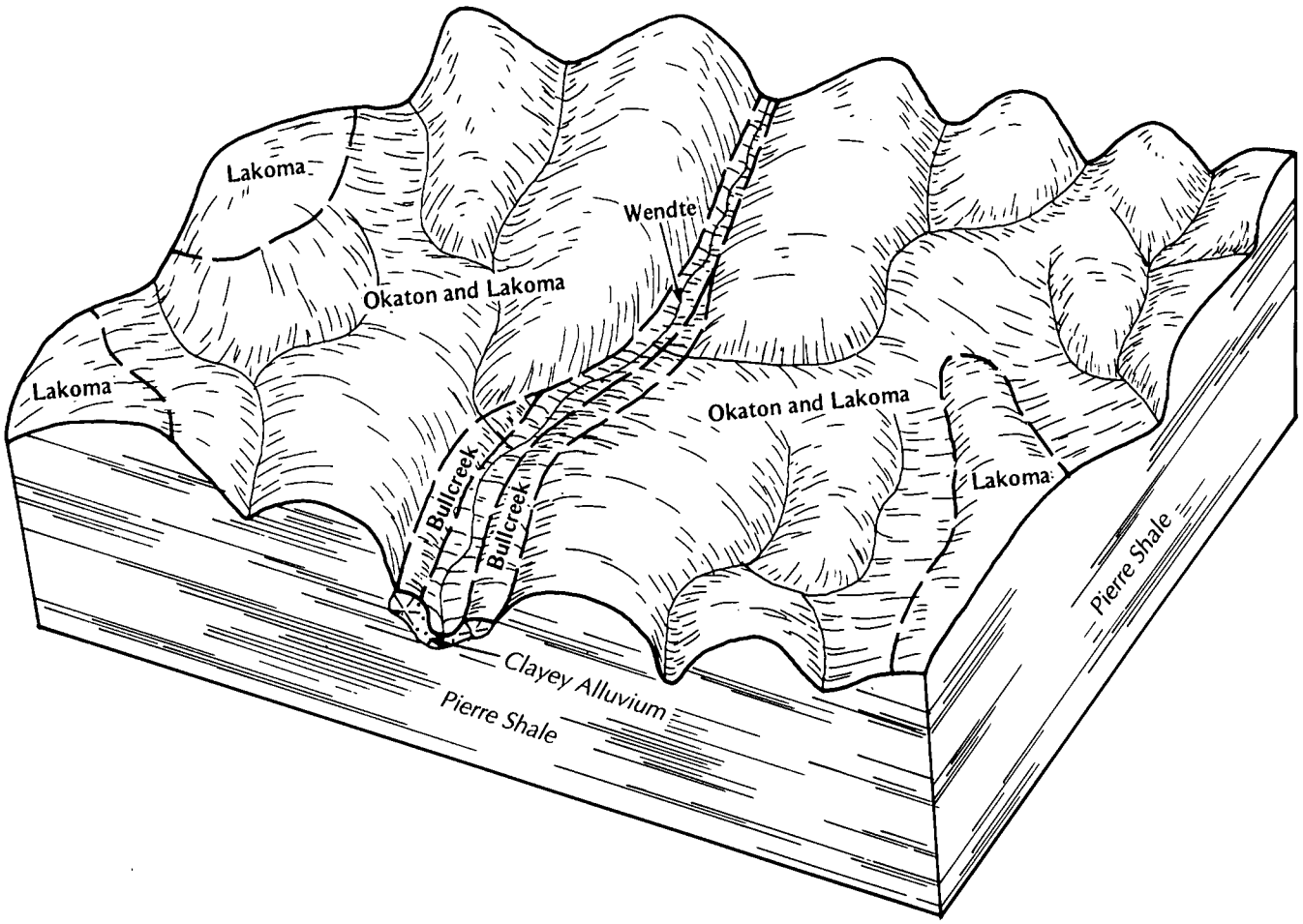

Figure 6.—Typical pattern of soils and parent material in the Okaton-Lakoma association.

clay. Light olive gray, calcareous shale is at a depth of about 14 inches.

Minor in this association are Bullcreek, Herdcamp, Lakoma, Promise, Wendte, and Witten soils. The dense Bullcreek soils are on foot slopes on terraces and fans below the Opal soils. The very poorly drained Herdcamp soils are on low flood plains. The moderately deep Lakoma soils are on back slopes. The deep and very deep Promise soils are on the lower back slopes and foot slopes below the Opal soils. The moderately well drained, stratified Wendte soils are on high flood plains. The moderately well drained Witten soils are on foot slopes.

About 60 percent of this association is rangeland and is used for grazing or hay. The rest is mainly used as cropland and is used for forage or cash crops. Maintaining plant vigor, controlling water erosion, and preventing the formation of gullies along cattle trails are the main management concerns affecting rangeland. The major soils are suited to rangeland and to rangeland wildlife habitat. The less sloping areas of the Opal soils and some areas of the minor soils are suited to cultivated crops and to tame pasture and hay, but the shallow depth to bedrock and the slope of the Sansarc soils are limitations. Winter wheat, grain sorghum, forage sorghum, and alfalfa are the main crops. Conserving moisture, controlling erosion, and the slow water intake rate are the main management concerns affecting cultivated areas.

11. Sansarc-Opal Association

Shallow and moderately deep, well drained, moderately sloping to very steep, clayey soils on dissected plains

This association is characterized by deeply entrenched drainageways. The soils formed in clayey residuum of shale. Slopes generally are strongly

sloping to steep but are moderately sloping in some areas and very steep in other areas. The drainage pattern is well defined.

This association makes up about 6 percent of the county. It is about 60 percent Sansarc soils, 15 percent Opal soils, and 25 percent minor soils (fig. 4).

The shallow Sansarc soils are on shoulder slopes and back slopes along drainageways. Slopes range from 15 to 60 percent. Typically, the surface layer and the transitional layer are olive gray, calcareous clay. The underlying material is light olive gray, calcareous clay. Light olive gray, calcareous shale is at a depth of about 14 inches.

The moderately deep Opal soils are on summits and back slopes. Slopes range from 6 to 25 percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown and light brownish gray, calcareous clay. The underlying material is light brownish gray, calcareous clay that has masses of gypsum and other salts. Light brownish gray shale is at a depth of about 35 inches.

Minor in this association are Bullcreek, Herdcamp, Lakoma, Okaton, Promise, and Wendte soils. The dense Bullcreek soils are on terraces and fans below the Opal soils. The very poorly drained Herdcamp soils are on low flood plains. The moderately deep Lakoma soils are on summits and back slopes. The deep and very deep Promise soils are on the lower back slopes and foot slopes below the Opal soils. The moderately well drained, stratified Wendte soils are on high flood plains.

Nearly all of this association supports native grasses and is used for grazing. Maintaining plant vigor, controlling water erosion, and preventing the formation of gullies along cattle trails are the main management concerns affecting rangeland. The major soils are suited to rangeland and to rangeland wildlife habitat. They are not suited to cultivated crops and tame pasture and hay because of the slope and the shallow depth to bedrock.

Nearly Level to Steep, Loamy and Clayey Soils on Terraces and Dissected Plains

These soils dominantly are strongly sloping but are nearly level to moderately sloping in some places and moderately steep and steep in other places. They make up about 4 percent of the county. About 55 percent of the acreage is cropland. The rest is mainly used for rangeland or hay. Controlling erosion and conserving moisture are the main concerns in managing cultivated areas.

12. Kirley-Lakoma-Vivian Association

Very deep to moderately deep, well drained and somewhat excessively drained, nearly level to steep, loamy and clayey soils on terraces and dissected plains

This association is characterized by gravelly breaks and buttes separated by deeply entrenched drainageways or nearly level terraces. Slopes dominantly are moderately sloping to moderately steep but are nearly level in some areas and steep in other areas. The drainage pattern is well defined.

This association makes up about 4 percent of the county. It is about 40 percent Kirley soils, 30 percent Lakoma soils, 20 percent Vivian soils, and 10 percent minor soils.

The very deep, loamy Kirley soils are on summits and back slopes. Slopes range from 0 to 15 percent. Typically, the surface layer is dark gray clay loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay and clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

The moderately deep, clayey Lakoma soils are on summits and back slopes. Slopes range from 6 to 25 percent. Typically, the surface layer is dark grayish brown, calcareous silty clay. The subsoil and the underlying material are grayish brown and light brownish gray, calcareous silty clay. Pale yellow, calcareous shale is at a depth of about 36 inches.

The deep, loamy Vivian soils are on summits and shoulder slopes. Slopes range from 2 to 40 percent. Typically, the surface layer is grayish brown, calcareous gravelly loam. The underlying material is pale brown, calcareous very gravelly loam. Pale yellow, calcareous shale is at a depth of about 50 inches.

Minor in this association are Bullcreek, Mosher, Okaton, Ree, and Wendte soils. The dense Bullcreek soils are on foot slopes on terraces and fans along drainageways. The moderately well drained, sodium-affected Mosher soils are on foot slopes. The shallow Okaton soils are on shoulder slopes and back slopes below the Vivian soils. The loamy Ree soils are in similar landscape positions to those of the Kirley soils. The moderately well drained, stratified Wendte soils are on high flood plains.

About 55 percent of this association is cropland. The rest is mainly used for rangeland or hay. The Kirley soil and the less sloping areas of the Lakoma soil are suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat. Winter wheat, grain sorghum, oats, and alfalfa are the main

crops. Controlling erosion and conserving moisture are the main management concerns affecting cultivated areas. A low available water capacity in the Lakoma and Vivian soils and the slow water intake rate in the Lakoma soils also are management concerns. Maintaining the most productive grasses is the main management concern affecting rangeland.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects the use or management of the soil. For example, Kirley clay loam, 6 to 9 percent slopes, is a phase of the Kirley series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Kirley-Mosher complex, 0 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Orthents, gravelly, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ab—Albaton silty clay, depressional

Composition

Albaton and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, mottled, calcareous silty clay

Underlying layer:
6 to 60 inches—grayish brown, mottled, calcareous clay

Soil Properties and Qualities

Drainage class: Very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 4 feet above to 2 feet below the surface
Flooding: Frequent for brief periods
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Very low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes on fans or terraces
• The moderately well drained Wendte soils on high flood plains

Similar inclusions:
• Soils that have silty material within a depth of 40 inches
• Soils that have sandy material within a depth of 40 inches

Use and Management

Cropland and pasture

Management considerations:
• This soil is poorly suited to cropland.
Dominant use:
• Most of the acreage is used as pasture, rangeland, or wildlife habitat.
Management concerns: Wetness; the high content of lime, which adversely affects the availability of plant nutrients; wind erosion; surface compaction during wet periods
Management measures:
• Restricted grazing during wet periods, maintaining proper stocking rates, and deferred grazing help to improve plant vigor, help to control wind erosion, and minimize surface compaction.

Interpretive Groups

Land capability classification: IVw-1
Range site: Clayey Overflow
Windbreak suitability group: 10
Pasture suitability group: B2

Bb—Bigbend silt loam

Composition

Bigbend and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 8 inches—light brownish gray, calcareous silt loam

Underlying layer:
8 to 60 inches—light gray, calcareous very fine sandy loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Bigbend soil; in positions on the landscape similar to those of the Bigbend soil
• The excessively drained Inavale soils, which contain more sand than the Bigbend soil; on high flood plains

Similar inclusions:
• Soils that have a surface layer of silty clay loam
• Soils that have a surface layer of very fine sandy loam

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, forage sorghum, corn, and alfalfa

Management concerns: Conserving moisture; the high content of lime, which adversely affects the availability of plant nutrients; wind erosion
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
• Rotations that include grasses and legumes help to control wind erosion and maintain the content of organic matter, fertility, and tilth. Field windbreaks also help to control wind erosion.

Interpretive Groups

Land capability classification: IIc-1
Range site: Loamy Terrace
Windbreak suitability group: 1
Pasture suitability group: F

Bf—Bigbend silt loam, flooded

Composition

Bigbend and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 8 inches—light brownish gray, calcareous silt loam

Underlying layer:
8 to 60 inches—light gray, calcareous very fine sandy loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Frequent for brief periods
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Bigbend soil; in positions on the landscape similar to those of the Bigbend soil
• The excessively drained Inavale soils, which contain more sand than the Bigbend soil; on the higher flood plains
• The very poorly drained Albaton soils, which contain more clay throughout than the Bigbend soil; on low flood plains

Similar inclusions:
• Soils that have a surface layer of silty clay loam
• Soils that have a surface layer of very fine sandy loam

Use and Management

Rangeland

Management concerns: Wetness; the high content of lime, which adversely affects the availability of plant nutrients; wind erosion
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control wind erosion.

Interpretive Groups

Land capability classification: VIw-1
Range site: Loamy Overflow
Windbreak suitability group: 1
Pasture suitability group: F

Bg—Bigbend silty clay loam

Composition

Bigbend and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 10 inches—light brownish gray, calcareous silty clay loam

Underlying layer:
10 to 60 inches—light gray, calcareous very fine sandy loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Bigbend soil; in positions on the landscape similar to those of the Bigbend soil
• The moderately well drained Wendte soils, which contain more clay throughout than the Bigbend soil; in positions on the landscape similar to those of the Bigbend soil

Similar inclusions:
• Soils that have a surface layer of silt loam

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, forage sorghum, corn, and alfalfa
Management concerns: Conserving moisture; the high content of lime, which adversely affects the availability of plant nutrients; wind erosion
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
• Rotations that include grasses and legumes help to control wind erosion and maintain the content of organic matter, fertility, and tilth. Field windbreaks also help to control wind erosion.

Interpretive Groups

Land capability classification: IIc-1
Range site: Loamy Terrace
Windbreak suitability group: 1
Pasture suitability group: F

Bh—Bigbend very fine sandy loam

Composition

Bigbend and similar soils: 95 to 99 percent
Contrasting inclusions: 1 to 5 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 8 inches—light brownish gray, calcareous very fine sandy loam

Underlying layer:
8 to 60 inches—light gray, calcareous very fine sandy loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Bigbend soil; in positions on the landscape similar to those of the Bigbend soil
• The excessively drained Inavale soils, which contain more sand than the Bigbend soil; on the higher flood plains

Similar inclusions:
• Soils that have a surface layer of silt loam

Use and Management

Cropland

Main crops: Winter wheat, forage sorghum, and alfalfa
Management concerns: Wind erosion; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
• Rotations that include grasses and legumes help to

control wind erosion and maintain the content of organic matter, fertility, and tilth. Field windbreaks also help to control wind erosion.

Interpretive Groups

Land capability classification: IIe-1
Range site: Loamy Terrace
Windbreak suitability group: 1
Pasture suitability group: F

Bi—Bigbend-Inavale complex

Composition

Bigbend and similar soils: 45 to 50 percent
Inavale and similar soils: 40 to 45 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Flood plains
Landform position: Bigbend—high flood plains; Inavale—high flood plains above the Bigbend soil
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 10 to 150 acres

Typical Profile

Bigbend

Surface layer:
0 to 8 inches—light brownish gray, calcareous very fine sandy loam

Underlying layer:
8 to 60 inches—light gray, calcareous very fine sandy loam

Inavale

Surface layer:
0 to 4 inches—grayish brown loamy fine sand

Transitional layer:
4 to 8 inches—light brownish gray, calcareous loamy fine sand

Underlying layer:
8 to 60 inches—light gray, calcareous fine sand stratified with thin layers of loamy fine sand

Soil Properties and Qualities

Drainage class: Bigbend—well drained; Inavale—excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Bigbend—moderate; Inavale—rapid
Available water capacity: Bigbend—high; Inavale—low
Organic matter content: Bigbend—moderately low; Inavale—low
Surface runoff: Bigbend—low; Inavale—very low
Other properties: A high content of lime in the Bigbend soil

Inclusions

Contrasting inclusions:
- The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Bigbend and Inavale soils; in positions on the landscape similar to those of the Bigbend soil
- The moderately well drained Wendte soils, which contain more clay than the Bigbend and Inavale soils; in positions on the landscape similar to those of the Bigbend soil
- The very poorly drained Albaton soils, which contain more clay throughout than the Bigbend and Inavale soils; on low flood plains

Use and Management

Cropland

Main crops: Winter wheat, forage sorghum, and alfalfa
Management concerns: Bigbend—wind erosion; the high content of lime, which adversely affects the availability of plant nutrients; Inavale—wind erosion; low available water capacity
Management measures:
- Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
- Rotations that include grasses and legumes help to control wind erosion and maintain the content of organic matter, fertility, and tilth. Field windbreaks also help to control wind erosion.

Interpretive Groups

Land capability classification: Bigbend—IIe-1; Inavale—IVe-9
Range site: Bigbend—Loamy Terrace; Inavale—Sands
Windbreak suitability group: Bigbend—1; Inavale—7
Pasture suitability group: Bigbend—F; Inavale—H

Bu—Bullcreek clay, 0 to 6 percent slopes

Composition

Bullcreek and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Fans or terraces
Landform position: Foot slopes
Slope range: 0 to 6 percent
Shape of areas: Irregular or long and narrow
Size of areas: 5 to 400 acres

Typical Profile

Surface layer:
0 to 3 inches—grayish brown clay

Subsoil:
3 to 12 inches—grayish brown clay
12 to 25 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
25 to 60 inches—grayish brown and light brownish gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderately low
Surface runoff: Medium
Other properties: A high content of salts

Inclusions

Contrasting inclusions:
• The moderately well drained Capa soils, which have a sodium-affected subsoil; in positions on the landscape similar to those of the Bullcreek soil
• The well drained Promise soils, which do not have visible salts within a depth of 20 inches; on adjacent plains on the lower back slopes and foot slopes
• The moderately well drained, stratified Wendte soils on high flood plains
• Slickspots, which have salts at or near the surface; on the lower foot slopes

Use and Management

Rangeland

Management concerns: A slow rate of water intake, a high concentration of salt, wind erosion
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control wind erosion.

Interpretive Groups

Land capability classification: VIs-5
Range site: Dense Clay
Windbreak suitability group: 10
Pasture suitability group: NS

Bx—Bullcreek-Slickspots complex

Composition

Bullcreek and similar soils: 50 to 60 percent
Slickspots and similar inclusions: 25 to 40 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Fans or terraces
Landform position: Bullcreek—foot slopes; Slickspots—the lower foot slopes
Slope range: 0 to 3 percent
Shape of areas: Irregular or long and narrow
Size of areas: 10 to 200 acres

Typical Profile

Bullcreek

Surface layer:
0 to 3 inches—grayish brown clay

Subsoil:
3 to 12 inches—grayish brown clay
12 to 25 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
25 to 60 inches—grayish brown and light brownish gray, calcareous clay with masses of gypsum and other salts

Slickspots

• Slickspots have a light gray, dispersed surface crust and dense, massive underlying material.
• Accumulations of visible salts are at or near the surface.
• Slickspots are barren or nearly barren of vegetation.

Soil Properties and Qualities

Drainage class: Bullcreek—well drained; Slickspots—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet

Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Bullcreek—moderate; Slickspots—low
Organic matter content: Bullcreek—moderately low; Slickspots—low
Surface runoff: Low
Other properties: Both the Bullcreek soil and Slickspots have a high content of salts.

Inclusions

Contrasting inclusions:
• The moderately well drained Capa soils, which have a sodium-affected subsoil; in positions on the landscape similar to those of the Bullcreek soil
• The well drained Promise soils, which do not have visible salts within a depth of 20 inches; on plains on the lower back slopes and foot slopes
• The moderately well drained, stratified Wendte soils on high flood plains

Use and Management

Rangeland

Management concerns: A slow rate of water intake, a high concentration of salt, wind erosion
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control wind erosion.

Interpretive Groups

Land capability classification: Bullcreek—VIs-5; Slickspots—VIIIs-3
Range site: Bullcreek—Dense Clay; Slickspots—Not assigned
Windbreak suitability group: Bullcreek—10; Slickspots—10
Pasture suitability group: Bullcreek—NS; Slickspots—NS

CpA—Capa silt loam, 0 to 6 percent slopes

Composition

Capa and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Plains
Landform position: Foot slopes
Slope range: 0 to 6 percent
Shape of areas: Irregular or long and narrow
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 1 inch—light brownish gray silt loam

Subsoil:
1 to 4 inches—dark grayish brown clay
4 to 11 inches—dark grayish brown, calcareous clay
11 to 31 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
31 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Low
Surface runoff: Medium
Other properties: A sodium-affected subsoil

Inclusions

Contrasting inclusions:
• The well drained Kirley soils, which do not have a sodium-affected subsoil; on back slopes on terraces
• The moderately deep, well drained Opal soils, which do not have a sodium-affected subsoil; on back slopes
• The well drained Promise soils, which do not have a sodium-affected subsoil; on the lower back slopes and foot slopes
• Slickspots, which have salts at or near the surface; on the lower foot slopes

Use and Management

Rangeland

Management concerns: A sodium-affected subsoil, which adversely affects plant growth by restricting root penetration; a slow rate of water intake
Management measures:
• Proper grazing management helps to maintain plant vigor and conserves moisture.

Interpretive Groups

Land capability classification: VIs-1
Range site: Thin Claypan
Windbreak suitability group: 10
Pasture suitability group: NS

Hb—Herdcamp-Bullcreek complex

Composition

Herdcamp and similar soils: 50 to 65 percent
Bullcreek and similar soils: 25 to 40 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Flood plains and fans
Landform position: Herdcamp—low flood plains; Bullcreek—foot slopes on fans
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 15 to 75 acres

Typical Profile

Herdcamp

Surface layer:
0 to 6 inches—dark gray, mottled, calcareous silty clay with nests of gypsum and other salts

Underlying layer:
6 to 60 inches—dark gray and gray, mottled, calcareous silty clay with nests of gypsum and other salts

Bullcreek

Surface layer:
0 to 3 inches—grayish brown clay

Subsoil:
3 to 12 inches—grayish brown clay
12 to 25 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
25 to 60 inches—grayish brown and light brownish gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Herdcamp—very poorly drained; Bullcreek—well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: Herdcamp—0 to 1 foot; Bullcreek—more than 6 feet
Flooding: Herdcamp—frequent for long periods; Bullcreek—rare
Ponding: None
Permeability: Herdcamp—slow; Bullcreek—very slow
Available water capacity: Moderate
Organic matter content: Herdcamp—moderate; Bullcreek—moderately low
Surface runoff: Herdcamp—very low; Bullcreek—low
Other properties: Both soils have a high content of salts.

Inclusions

Contrasting inclusions:
• The shallow, well drained Okaton soils on shoulder slopes and back slopes on dissected plains
• Slickspots, which have salts at or near the surface; on foot slopes

Use and Management

Rangeland

Management concerns: Herdcamp—wetness, a slow rate of water intake, a high concentration of salt, wind erosion, surface compaction during wet periods, meandering channels; Bullcreek—a slow rate of water intake, wind erosion, a high concentration of salt
Management measures:
• Restricted grazing during wet periods, maintaining proper stocking rates, and deferred grazing help to improve plant vigor and minimize surface compaction.

Interpretive Groups

Land capability classification: Herdcamp—Vlw-2; Bullcreek—Vls-5
Range site: Herdcamp—Wetland; Bullcreek—Dense Clay
Windbreak suitability group: Herdcamp—10; Bullcreek—10
Pasture suitability group: Herdcamp—B1; Bullcreek—NS

Hg—Hilmoe silt loam, overwash

Composition

Hilmoe and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 8 inches—white, calcareous silt loam

Underlying layer:
8 to 40 inches—grayish brown and light brownish gray, calcareous silty clay

40 to 60 inches—light gray, calcareous silt loam stratified with thin layers of very fine sandy loam and clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over silty alluvium
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Slow
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Low
Other properties: The surface layer has an overwash of lighter colored material that is not typical for the range of the series and has a high content of lime.

Inclusions

Similar inclusions:
- Soils that have a surface layer of silty clay
- Soils that are silty throughout

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
- Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
- Rotations that include grasses and legumes help to control wind erosion and maintain the content of organic matter, fertility, and tilth. Field windbreaks also help to control wind erosion.

Interpretive Groups

Land capability classification: IIs-1
Range site: Loamy Overflow
Windbreak suitability group: 4
Pasture suitability group: E

Hm—Hilmoe silty clay

Composition

Hilmoe and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 7 inches—grayish brown, calcareous silty clay

Underlying layer:
7 to 30 inches—light brownish gray, calcareous silty clay
30 to 60 inches—light gray, calcareous silt loam stratified with thin layers of very fine sandy loam and clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over silty alluvium
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
- The well drained Bigbend soils, which contain less clay in the upper part than the Hilmoe soil; in positions on the landscape similar to those of the Hilmoe soil
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes on fans or terraces
- The very poorly drained Albaton soils on low flood plains

Similar inclusions:
- Soils that have clayey material extending below a depth of 40 inches

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, forage sorghum, corn, and alfalfa
Management concerns: Wind erosion; the high content of lime, which adversely affects the availability of plant nutrients

Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
• Rotations that include grasses and legumes help to control wind erosion and maintain the content of organic matter, fertility, and tilth. Field windbreaks also help to control wind erosion.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Clayey Overflow
Windbreak suitability group: 4
Pasture suitability group: I

Hn—Hilmoe-Inavale complex

Composition

Hilmoe and similar soils: 45 to 50 percent
Inavale and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Flood plains
Landform position: Hilmoe—high flood plains; Inavale—high flood plains above the Hilmoe soil
Slope range: 0 to 1 percent
Shape of areas: Long and narrow or irregular
Size of areas: 10 to 100 acres

Typical Profile

Hilmoe

Surface layer:
0 to 7 inches—grayish brown, calcareous silty clay

Underlying layer:
7 to 30 inches—light brownish gray, calcareous silty clay
30 to 60 inches—light gray, calcareous silt loam stratified with thin layers of very fine sandy loam and clay loam

Inavale

Surface layer:
0 to 4 inches—grayish brown loamy fine sand

Transitional layer:
4 to 8 inches—light brownish gray, calcareous loamy fine sand

Underlying layer:
8 to 60 inches—light gray, calcareous fine sand stratified with thin layers of loamy fine sand

Soil Properties and Qualities

Drainage class: Hilmoe—moderately well drained; Inavale—excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: Hilmoe—20 to 40 inches over silty alluvium; Inavale—more than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Hilmoe—occasional for brief periods; Inavale—occasional for very brief periods
Ponding: None
Permeability: Hilmoe—slow; Inavale—rapid
Available water capacity: Hilmoe—high; Inavale—low
Organic matter content: Hilmoe—moderate; Inavale—low
Surface runoff: Hilmoe—low; Inavale—very low
Other properties: A high content of lime in the Hilmoe soil

Inclusions

Contrasting inclusions:
• The well drained, silty Bigbend soils on high flood plains
• The very poorly drained Albaton soils, which contain more clay than the Hilmoe and Inavale soils; on low flood plains

Similar inclusions:
• Soils that are similar to the Hilmoe soil but have clayey material extending below a depth of 40 inches
• Soils that have more clay in the surface layer than the Inavale soil

Use and Management

Cropland and pasture

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Dominant use:
• Most of the acreage is used as pasture and rangeland.
Management concerns: Hilmoe—wetness; the high content of lime, which adversely affects plant nutrients; Inavale—wind erosion, wetness, low available water capacity
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter and tilth. Field windbreaks also help to control wind erosion.
• Restricted grazing during wet periods, maintaining proper stocking rates, and deferred grazing help to improve plant vigor and help to control erosion.

Interpretive Groups

Land capability classification: Hilmoe—IIIs-3; Inavale—IVe-9
Range site: Hilmoe—Clayey Overflow; Inavale—Sands
Windbreak suitability group: Hilmoe—4; Inavale—7
Pasture suitability group: Hilmoe—I; Inavale—H

Ho—Hoven silt loam

Composition

Hoven and similar soils: 95 to 99 percent
Contrasting inclusions: 1 to 5 percent

Setting

Landform: Plains
Landform position: Basins
Slope range: 0 to 1 percent
Shape of areas: Circular or oblong
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 4 inches—gray, mottled silt loam

Subsoil:
4 to 23 inches—dark grayish brown and grayish brown clay
23 to 35 inches—grayish brown, calcareous clay

Underlying layer:
35 to 46 inches—grayish brown, calcareous clay with few masses of gypsum and other salts
46 to 60 inches—light brownish gray, calcareous clay with many masses of gypsum

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 1.0 foot above to 1.5 feet below the surface
Flooding: None
Ponding: Occasional for long periods
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Negligible

Inclusions

Contrasting inclusions:
- The moderately well drained Capa soils, which have sodium salts above a depth of 16 inches; on foot slopes
- The moderately well drained Mosher soils, which have a thicker surface layer and subsurface layer than those of the Hoven soil; on foot slopes

Similar inclusions:
- Soils that do not have a sodium-affected subsoil

Use and Management

Rangeland

Management concerns: Wetness, surface compaction during wet periods
Management measures:
- Restricted grazing during wet periods, maintaining proper stocking rates, and deferred grazing help to improve plant vigor and minimize surface compaction.

Interpretive Groups

Land capability classification: VIs-1
Range site: Closed Depression
Windbreak suitability group: 10
Pasture suitability group: B2

In—Inavale loamy fine sand

Composition

Inavale and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 10 to 150 acres

Typical Profile

Surface layer:
0 to 4 inches—grayish brown loamy fine sand

Transitional layer:
4 to 8 inches—light brownish gray, calcareous loamy fine sand

Underlying layer:
8 to 60 inches—light gray, calcareous fine sand stratified with thin layers of loamy fine sand

Soil Properties and Qualities

Drainage class: Excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Rapid
Available water capacity: Low

Organic matter content: Low
Surface runoff: Very low

Inclusions

Contrasting inclusions:
- The well drained Bigbend soils, which contain less sand than the Inavale soil; on the lower flood plains
- The moderately well drained Hilmoe soils, which contain more clay than the Inavale soil; on the slightly lower flood plains
- The very poorly drained Albaton soils, which contain more clay throughout than the Inavale soil; on low flood plains

Similar inclusions:
- Soils that have a surface layer of fine sandy loam
- Soils that have a surface layer of silty clay loam

Use and Management

Cropland and pasture

Management considerations:
- This soil is poorly suited to cropland.

Dominant use:
- Most of the acreage is used as rangeland.

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Wind erosion, the formation of sand blowouts along livestock trails and around watering facilities
Management measures:
- Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.
- Deferred grazing and maintaining proper stocking rates help to improve plant vigor. Rangeland seeding is needed on some sites.

Interpretive Groups

Land capability classification: IVe-9
Range site: Sands
Windbreak suitability group: 7
Pasture suitability group: H

KeA—Kirley clay loam, 0 to 2 percent slopes

Composition

Kirley and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Terraces
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 500 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Low

Inclusions

Contrasting inclusions:
- The poorly drained and very poorly drained Kolls soils in basins
- The moderately well drained, sodium-affected Mosher soils on foot slopes

Similar inclusions:
- Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Few limitations, except conserving moisture
Management measures:
- Managing crop residue helps to conserve moisture and helps to maintain the content of organic matter and tilth.

Interpretive Groups

Land capability classification: IIc-2
Range site: Clayey
Windbreak suitability group: 3
Pasture suitability group: F

KeB—Kirley clay loam, 2 to 6 percent slopes

Composition

Kirley and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Terraces
Landform position: Back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
- The poorly drained and very poorly drained Kolls soils in basins
- The moderately well drained, sodium-affected Mosher soils on foot slopes

Similar inclusions:
- Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Water erosion
Management measures:
- Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control water erosion.
- Rotations that include grasses and legumes help to control water erosion and maintain the content of organic matter and tilth. Stripcropping, contour farming, and grassed waterways also help to control water erosion.

Interpretive Groups

Land capability classification: IIe-1
Range site: Clayey
Windbreak suitability group: 3
Pasture suitability group: F

KeC—Kirley clay loam, 6 to 9 percent slopes

Composition

Kirley and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Terraces
Landform position: Shoulder slopes and back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 10 to 75 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained

Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: High

Inclusions

Contrasting inclusions:
• The moderately deep Lakoma soils, which contain more clay than the Kirley soil; on shoulder slopes and the upper back slopes on dissected plains
• The somewhat excessively drained Vivian soils, which have underlying gravelly material; on summits and shoulder slopes

Similar inclusions:
• Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Water erosion
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control water erosion.
• Rotations that include grasses and legumes help to control water erosion and maintain the content of organic matter and tilth. Stripcropping, contour farming, terraces, and grassed waterways also help to control water erosion.

Interpretive Groups

Land capability classification: IIIe-1
Range site: Clayey
Windbreak suitability group: 3
Pasture suitability group: F

KeD—Kirley clay loam, 9 to 15 percent slopes

Composition

Kirley and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Terraces
Landform position: Shoulder slopes and back slopes
Slope range: 9 to 15 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Very high

Inclusions

Contrasting inclusions:
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
• The moderately deep Lakoma soils, which contain more clay than the Kirley soil; on shoulder slopes and the upper back slopes on dissected plains
• The somewhat excessively drained Vivian soils, which have underlying gravelly material; on summits and shoulder slopes
• The shallow Okaton soils, which are on dissected plains on shoulder slopes and the upper back slopes

Similar inclusions:
• Soils that contain less clay in the subsoil than the Kirley soil
• Soils that have shale within a depth of 20 to 40 inches

Use and Management

Cropland

Main crops: Winter wheat, oats, and alfalfa
Management concerns: Water erosion

Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control water erosion.
• Rotations that include grasses and legumes help to control water erosion and maintain the content of organic matter and tilth. Stripcropping, contour farming, terraces, and grassed waterways also help to control water erosion.

Interpretive Groups

Land capability classification: IVe-1
Range site: Clayey
Windbreak suitability group: 3
Pasture suitability group: F

KmB—Kirley-Mosher complex, 0 to 6 percent slopes

Composition

Kirley and similar soils: 55 to 70 percent
Mosher and similar soils: 20 to 40 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Terraces
Landform position: Kirley—back slopes; Mosher—foot slopes
Slope range: Kirley—2 to 6 percent; Mosher—0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Kirley

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Mosher

Surface layer:
0 to 3 inches—gray silt loam

Subsurface layer:
3 to 6 inches—gray silt loam

Subsoil:
6 to 11 inches—dark grayish brown clay
11 to 25 inches—grayish brown, calcareous clay
25 to 40 inches—grayish brown, calcareous clay with masses of gypsum and other salts
40 to 60 inches—grayish brown, calcareous silty clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Kirley—well drained; Mosher—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: Kirley—more than 6 feet; Mosher—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Kirley—moderately slow; Mosher—very slow
Available water capacity: Kirley—high; Mosher—moderate
Organic matter content: Kirley—moderate; Mosher—moderately low
Surface runoff: Medium
Other properties: The Mosher soil has a sodium-affected subsoil.

Inclusions

Contrasting inclusions:
• The moderately well drained Capa soils, which have visible salts above a depth of 16 inches; on foot slopes
• The poorly drained Hoven soils in basins
• The poorly drained and very poorly drained Kolls soils in basins

Similar inclusions:
• Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Kirley—water erosion; Mosher—a sodium-affected subsoil, which adversely affects growth by restricting root penetration, a slow rate of water intake
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control water erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter and tilth.

• Chiseling and subsoiling when the soils are dry increase the rate of water infiltration.

Interpretive Groups

Land capability classification: Kirley—IIe-1; Mosher—IVs-2
Range site: Kirley—Clayey; Mosher—Claypan
Windbreak suitability group: Kirley—3; Mosher—9
Pasture suitability group: Kirley—F; Mosher—C

KnB—Kirley-Vivian complex, 2 to 6 percent slopes

Composition

Kirley and similar soils: 45 to 60 percent
Vivian and similar soils: 30 to 40 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Terraces
Landform position: Kirley—back slopes; Vivian—summits and shoulder slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Kirley

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Vivian

Surface layer:
0 to 4 inches—grayish brown, calcareous gravelly loam

Underlying layer:
4 to 50 inches—pale brown, calcareous very gravelly loam
50 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Kirley—well drained; Vivian—somewhat excessively drained
Depth to bedrock: Kirley—very deep; Vivian—deep
Depth to contrasting layer: Kirley—more than 60 inches; Vivian—40 to 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Kirley—moderately slow; Vivian—moderately rapid above the shale
Available water capacity: Kirley—high; Vivian—low
Organic matter content: Kirley—moderate; Vivian—low
Surface runoff: Medium
Other properties: A high content of lime in the Vivian soil

Inclusions

Contrasting inclusions:
• The moderately deep, well drained Lakoma soils, which contain more clay than the Kirley and Vivian soils; on back slopes on dissected plains

Similar inclusions:
• Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Kirley—water erosion; Vivian—wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; low available water capacity
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter, fertility, and tilth.

Interpretive Groups

Land capability classification: Kirley—IIe-1; Vivian—IVe-6
Range site: Kirley—Clayey; Vivian—Thin Upland
Windbreak suitability group: Kirley—3; Vivian—8
Pasture suitability group: Kirley—F; Vivian—D2

KnC—Kirley-Vivian complex, 6 to 9 percent slopes

Composition

Kirley and similar soils: 45 to 50 percent
Vivian and similar soils: 35 to 45 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Terraces
Landform position: Kirley—back slopes; Vivian—summits and shoulder slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Kirley

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Vivian

Surface layer:
0 to 4 inches—grayish brown, calcareous gravelly loam

Underlying layer:
4 to 50 inches—pale brown, calcareous very gravelly loam
50 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Kirley—well drained; Vivian—somewhat excessively drained
Depth to bedrock: Kirley—very deep; Vivian—deep
Depth to contrasting layer: Kirley—more than 60 inches; Vivian—40 to 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Kirley—moderately slow; Vivian—moderately rapid above the shale
Available water capacity: Kirley—high; Vivian—low
Organic matter content: Kirley—moderate; Vivian—low
Surface runoff: Kirley—high; Vivian—medium
Other properties: A high content of lime in the Vivian soil

Inclusions

Contrasting inclusions:
• The moderately deep, well drained Lakoma soils, which contain more clay than the Kirley and Vivian soils; on back slopes on dissected plains

Similar inclusions:
• Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Main crops: Winter wheat and alfalfa
Management concerns: Kirley—water erosion; Vivian—wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; low available water capacity
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter, fertility, and tilth.

Interpretive Groups

Land capability classification: Kirley—IIIe-1; Vivian—VIe-5
Range site: Kirley—Clayey; Vivian—Thin Upland
Windbreak suitability group: Kirley—3; Vivian—8
Pasture suitability group: Kirley—F; Vivian—D2

KnD—Kirley-Vivian complex, 9 to 25 percent slopes

Composition

Kirley and similar soils: 40 to 60 percent
Vivian and similar soils: 30 to 40 percent
Contrasting inclusions: 10 to 25 percent

Setting

Landform: Terraces
Landform position: Kirley—back slopes; Vivian—summits and shoulder slopes
Slope range: Kirley—9 to 15 percent; Vivian—9 to 25 percent
Shape of areas: Irregular

Size of areas: 25 to 1,500 acres

Typical Profile

Kirley

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Vivian

Surface layer:
0 to 4 inches—grayish brown, calcareous gravelly loam

Underlying layer:
4 to 50 inches—pale brown, calcareous very gravelly loam
50 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Kirley—well drained; Vivian—somewhat excessively drained
Depth to bedrock: Kirley—very deep; Vivian—deep
Depth to contrasting layer: Kirley—more than 60 inches; Vivian—40 to 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Kirley—moderately slow; Vivian—moderately rapid above the shale
Available water capacity: Kirley—high; Vivian—low
Organic matter content: Kirley—moderate; Vivian—low
Surface runoff: Kirley—very high; Vivian—high
Other properties: A high content of lime in the Vivian soil

Inclusions

Contrasting inclusions:
- The moderately deep, well drained Lakoma soils, which contain more clay than the Kirley and Vivian soils; on back slopes on dissected plains
- The shallow, well drained Okaton soils, which contain more clay than the Kirley and Vivian soils; on dissected plains on shoulder slopes and the upper back slopes

Similar inclusions:
- Soils that contain less clay in the subsoil than the Kirley soil

Use and Management

Cropland

Management considerations:
- The Kirley soil is poorly suited to cropland, and the Vivian soil is unsuited to cropland.

Dominant use:
- Most of the acreage is used as pasture and rangeland.

Management concerns: Kirley—wind erosion; Vivian—wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; low available water capacity; the formation of gullies along some cattle trails

Management measures:
- Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control erosion.
- Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter, fertility, and tilth.
- Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.

Interpretive Groups

Land capability classification: Kirley—IVe-1; Vivian—VIe-5
Range site: Kirley—Clayey; Vivian—Thin Upland
Windbreak suitability group: Kirley—3; Vivian—10
Pasture suitability group: Kirley—F; Vivian—NS

Ko—Kolls silty clay

Composition

Kolls and similar soils: 95 to 99 percent
Contrasting inclusions: 1 to 5 percent

Setting

Landform: Plains
Landform position: Basins
Slope range: 0 to 1 percent
Shape of areas: Circular or oblong
Size of areas: 5 to 120 acres

Typical Profile

Surface layer:
0 to 3 inches—dark gray, calcareous silty clay

Subsoil:
3 to 12 inches—dark gray, calcareous clay

12 to 23 inches—gray, calcareous clay
23 to 31 inches—gray, calcareous clay

Underlying layer:
31 to 42 inches—gray, calcareous clay with masses of gypsum and other salts
42 to 60 inches—olive gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 0 to 1.5 feet
Flooding: None
Ponding: Frequent for long periods
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Negligible
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
- The well drained Promise soils on foot slopes
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes on fans

Similar inclusions:
- Soils that have a sodium-affected subsoil

Use and Management

Rangeland

Management concerns: Wetness; a slow rate of water intake; wind erosion; the high content of lime, which adversely affects the availability of plant nutrients; surface compaction during wet periods
Management measures:
- Restricted grazing during wet periods, maintaining proper stocking rates, and deferred grazing help to improve plant vigor and minimize surface compaction.

Interpretive Groups

Land capability classification: Vw-4
Range site: Closed Depression
Windbreak suitability group: 10
Pasture suitability group: B2

Kp—Kolls silty clay, ponded

Composition

Kolls and similar soils: 95 to 99 percent
Contrasting inclusions: 1 to 5 percent

Setting

Landform: Plains
Landform position: Basins
Slope range: 0 to 1 percent
Shape of areas: Circular or oblong
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 3 inches—dark gray silty clay

Subsoil:
3 to 12 inches—dark gray clay; calcareous in the lower part
12 to 23 inches—gray, calcareous clay
23 to 31 inches—gray, calcareous clay

Underlying layer:
31 to 42 inches—gray, calcareous clay with masses of gypsum and other salts
42 to 60 inches—olive gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 1 foot above to 1 foot below the surface
Flooding: None
Ponding: Frequent for very long periods
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Negligible

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes on fans

Similar inclusions:
- Soils that have a sodium-affected subsoil
- Soils that have carbonates leached to a depth of 40 inches

Use and Management

Rangeland and Wildlife Habitat

Management concerns: Wetness, a slow rate of water intake, surface compaction during wet periods
Management measures:
- Restricted grazing during wet periods, maintaining proper stocking rates, and deferred grazing help to improve plant vigor and minimize surface compaction.

• The soil is best suited to wetland wildlife habitat.
• During dry periods this soil provides limited grazing value. Maintaining proper stocking rates and alternating the season of use help to improve plant vigor and minimize surface compaction.

Interpretive Groups

Land capability classification: VIIIw-1
Range site: Shallow Marsh
Windbreak suitability group: 10
Pasture suitability group: NS

LaB—Lakoma silty clay, 3 to 6 percent slopes

Composition

Lakoma and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Back slopes
Slope range: 3 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 400 acres

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, calcareous silty clay

Subsoil:
5 to 10 inches—grayish brown, calcareous silty clay
10 to 26 inches—light brownish gray, calcareous silty clay

Underlying layer:
26 to 36 inches—light brownish gray, calcareous silty clay
36 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Low
Organic matter content: Moderately low
Surface runoff: High
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
• The very deep, moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
• The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
• Soils that have a darker surface layer than that of the Lakoma soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Wind erosion; water erosion; a slow rate of water intake; low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, control erosion, and maintain fertility.
• Contour farming, grassed waterways, stripcropping, and field windbreaks help to control erosion.
• Chiseling or subsoiling improves tilth and increases the rate of water intake.

Interpretive Groups

Land capability classification: IIIe-4
Range site: Thin Upland
Windbreak suitability group: 8
Pasture suitability group: I

LaC—Lakoma silty clay, 6 to 9 percent slopes

Composition

Lakoma and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Setting

Landform: Dissected plains
Landform position: Back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 700 acres

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, calcareous silty clay

Subsoil:
5 to 10 inches—grayish brown, calcareous silty clay
10 to 26 inches—light brownish gray, calcareous silty clay

Underlying layer:
26 to 36 inches—light brownish gray, calcareous silty clay
36 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Low
Organic matter content: Moderately low
Surface runoff: Very high
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
• The very deep, moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
• The shallow Okaton soils on shoulder slopes and the upper back slopes
• The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
• Soils that have a darker surface layer than that of the Lakoma soil

Use and Management

Cropland

Main crops: Winter wheat and alfalfa
Management concerns: Wind erosion; water erosion; a slow rate of water intake; low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, control erosion, and maintain fertility.
• Contour farming, terraces, grassed waterways, stripcropping, and field windbreaks help to control erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IVe-4
Range site: Thin Upland
Windbreak suitability group: 8
Pasture suitability group: I

LaD—Lakoma silty clay, 6 to 15 percent slopes (fig. 11)

Composition

Lakoma and similar soils: 75 to 85 percent
Contrasting inclusions: 15 to 25 percent

Setting

Landform: Dissected plains
Landform position: Summits and back slopes
Slope range: 6 to 15 percent
Shape of areas: Irregular
Size of areas: 5 to 3,000 acres

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, calcareous silty clay

Subsoil:
5 to 10 inches—grayish brown, calcareous silty clay
10 to 26 inches—light brownish gray, calcareous silty clay

Underlying layer:
26 to 36 inches—light brownish gray, calcareous silty clay
36 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Low
Organic matter content: Moderately low

Surface runoff: Very high
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
- The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes along drainageways
- The shallow Okaton soils on shoulder slopes and the upper back slopes
- The somewhat excessively drained Vivian soils, which have underlying gravelly material; on summits and shoulder slopes
- The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
- Soils that have shale below a depth of 40 inches
- Soils that have a darker surface layer than that of the Lakoma soil

Use and Management

Rangeland

Management concerns: Wind erosion; water erosion; a slow rate of water intake; low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails
Management measures:
- Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
- Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: VIe-4
Range site: Thin Upland
Windbreak suitability group: 10
Pasture suitability group: I

LkC—Lakoma-Kirley complex, 4 to 9 percent slopes

Composition

Lakoma and similar soils: 55 to 75 percent
Kirley and similar soils: 20 to 40 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Lakoma—shoulder slopes and the upper back slopes; Kirley—the lower back slopes and foot slopes
Slope range: Lakoma—6 to 9 percent; Kirley—4 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Lakoma

Surface layer:
0 to 5 inches—dark grayish brown, calcareous silty clay

Subsoil:
5 to 10 inches—grayish brown, calcareous silty clay
10 to 26 inches—light brownish gray, calcareous silty clay

Underlying layer:
26 to 36 inches—light brownish gray, calcareous silty clay
36 to 60 inches—pale yellow, calcareous shale

Kirley

Surface layer:
0 to 6 inches—dark gray clay loam

Subsoil:
6 to 12 inches—dark grayish brown clay
12 to 18 inches—grayish brown clay
18 to 25 inches—grayish brown, calcareous clay loam
25 to 40 inches—light brownish gray, calcareous clay loam

Underlying layer:
40 to 60 inches—light brownish gray, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Lakoma—moderately deep; Kirley—very deep
Depth to contrasting layer: Lakoma—20 to 40 inches over shale; Kirley—more than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Lakoma—slow; Kirley—moderately slow
Available water capacity: Lakoma—low; Kirley—high
Organic matter content: Lakoma—moderately low; Kirley—moderate
Surface runoff: Lakoma—very high; Kirley—medium
Other properties: A high content of lime in the Lakoma soil

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Vivian soils,

which have underlying gravelly material; on summits and shoulder slopes

Similar inclusions:
- Soils that are similar to the Lakoma soil but have shale below a depth of 40 inches
- Soils that have a darker surface layer than that of the Lakoma soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Lakoma—wind erosion; water erosion; a slow rate of water intake; low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; Kirley—water erosion
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, control erosion, and maintain fertility.
- Contour farming, terraces, grassed waterways, stripcropping, and field windbreaks help to control erosion.
- Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: Lakoma—IVe-4; Kirley—IIe-1
Range site: Lakoma—Thin Upland; Kirley—Clayey
Windbreak suitability group: Lakoma—8; Kirley—3
Pasture suitability group: Lakoma—I; Kirley—F

LvE—Lakoma-Vivian complex, 9 to 25 percent slopes

Composition

Lakoma and similar soils: 40 to 60 percent
Vivian and similar soils: 15 to 35 percent
Contrasting inclusions: 10 to 25 percent

Setting

Landform: Dissected plains
Landform position: Lakoma—back slopes; Vivian—summits and shoulder slopes
Slope range: Lakoma—9 to 15 percent; Vivian—9 to 25 percent
Shape of areas: Irregular
Size of areas: 25 to 500 acres

Typical Profile

Lakoma

Surface layer:
0 to 5 inches—dark grayish brown, calcareous silty clay

Subsoil:
5 to 10 inches—grayish brown, calcareous silty clay
10 to 26 inches—light brownish gray, calcareous silty clay

Underlying layer:
26 to 36 inches—light brownish gray, calcareous silty clay
36 to 60 inches—pale yellow, calcareous shale

Vivian

Surface layer:
0 to 4 inches—grayish brown, calcareous gravelly loam

Underlying layer:
4 to 50 inches—pale brown, calcareous very gravelly loam
50 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Lakoma—well drained; Vivian—somewhat excessively drained
Depth to bedrock: Lakoma—moderately deep; Vivian—deep
Depth to contrasting layer: Lakoma—20 to 40 inches over shale; Vivian—40 to 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Lakoma—slow; Vivian—moderately rapid above the shale
Available water capacity: Low
Organic matter content: Lakoma—moderately low; Vivian—low
Surface runoff: Lakoma—very high; Vivian—high
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
- The very deep, well drained Kirley and Ree soils on back slopes below the Vivian soil
- The shallow, well drained Okaton soils on shoulder slopes and the upper back slopes

Similar inclusions:
• Soils that are similar to the Lakoma soil but have shale below a depth of 40 inches
• Soils that have a darker surface layer than that of the Lakoma soil

Use and Management

Rangeland

Management concerns: Lakoma—wind erosion; water erosion; a slow rate of water intake; low available water capacity; slope; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails; Vivian—wind erosion; the high content of lime, which adversely affects the availability of plant nutrients; low available water capacity; slope; the formation of gullies along some cattle trails
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: Lakoma—VIe-4; Vivian—VIe-5
Range site: Lakoma—Thin Upland; Vivian—Thin Upland
Windbreak suitability group: Lakoma—10; Vivian—10
Pasture suitability group: Lakoma—I; Vivian—NS

MIA—Millboro silty clay loam, 0 to 3 percent slopes

Composition

Millboro and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Plains
Landform position: Summits and back slopes
Slope range: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 5 to 500 acres

Typical Profile

Surface layer:
0 to 9 inches—dark gray and dark grayish brown, calcareous silty clay loam

Subsoil:
9 to 18 inches—grayish brown, calcareous silty clay

18 to 29 inches—grayish brown, calcareous silty clay

Underlying layer:
29 to 39 inches—grayish brown, calcareous silty clay
39 to 60 inches—grayish brown, calcareous silty clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Medium
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
• The poorly drained and very poorly drained Kolls soils in basins
• The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes

Similar inclusions:
• Soils that contain more clay throughout than the Millboro soil
• Soils that contain less clay in the underlying material than the Millboro soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, corn, oats, and alfalfa
Management concerns: Wind erosion; a slow rate of water intake; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, maintain the content of organic matter and fertility, and help to control wind erosion.
• Stripcropping and field windbreaks help to control wind erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIs-2

Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

MIB—Millboro silty clay loam, 3 to 6 percent slopes

Composition

Millboro and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Plains
Landform position: Back slopes
Slope range: 3 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 1,500 acres

Typical Profile

Surface layer:
0 to 9 inches—dark gray and dark grayish brown, calcareous silty clay loam

Subsoil:
9 to 18 inches—grayish brown, calcareous silty clay
18 to 29 inches—grayish brown, calcareous silty clay

Underlying layer:
29 to 39 inches—grayish brown, calcareous silty clay
39 to 60 inches—grayish brown, calcareous silty clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: High
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
- The poorly drained and very poorly drained Kolls soils in basins
- The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes

Similar inclusions:
- Soils that contain more clay throughout than the Millboro soil
- Soils that contain less clay in the underlying material than the Millboro soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, corn, oats, and alfalfa
Management concerns: Wind erosion; water erosion; a slow rate of water intake; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, maintain the content of organic matter and fertility, and help to control erosion.
- Contour farming, grassed waterways, stripcropping, and field windbreaks help to control erosion.
- Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

MIC—Millboro silty clay loam, 6 to 9 percent slopes

Composition

Millboro and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Plains
Landform position: Back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 75 acres

Typical Profile

Surface layer:
0 to 9 inches—dark gray and dark grayish brown, calcareous silty clay loam

Subsoil:
9 to 18 inches—grayish brown, calcareous silty clay

18 to 29 inches—grayish brown, calcareous silty clay

Underlying layer:
29 to 39 inches—grayish brown, calcareous silty clay
39 to 60 inches—grayish brown, calcareous silty clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Very high
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
- The moderately deep, well drained Lakoma soils on the upper back slopes
- The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes

Similar inclusions:
- Soils that contain more clay throughout than the Millboro soil
- Soils that contain less clay in the underlying material than the Millboro soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, corn, oats, and alfalfa
Management concerns: Wind erosion; water erosion; a slow rate of water intake; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, maintain the content of organic matter and fertility, and help to control erosion.
- Contour farming, grassed waterways, terraces, stripcropping, and field windbreaks help to control erosion.
- Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IVe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

Mo—Mosher silt loam

Composition

Mosher and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Terraces
Landform position: Foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 160 acres

Typical Profile

Surface layer:
0 to 3 inches—gray silt loam

Subsurface layer:
3 to 6 inches—light gray silt loam

Subsoil:
6 to 11 inches—dark grayish brown clay
11 to 25 inches—grayish brown, calcareous clay
25 to 40 inches—grayish brown, calcareous clay with masses of gypsum and other salts
40 to 60 inches—grayish brown, calcareous silty clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 3 to 5 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderately low
Surface runoff: Medium
Other properties: A sodium-affected subsoil

Inclusions

Contrasting inclusions:
- Capa soils, which have visible salts within a depth of 16 inches; on the lower foot slopes
- The well drained Kirley soils, which do not have a sodium-affected subsoil; on back slopes

• The poorly drained and very poorly drained Kolls soils in basins

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: A sodium-affected subsoil, which adversely affects plant growth by restricting root penetration; a slow rate of water intake
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture.
• Rotations that include grasses and legumes and chiseling and subsoiling improve tilth and increase the rate of water infiltration.

Interpretive Groups

Land capability classification: IVs-2
Range site: Claypan
Windbreak suitability group: 9
Pasture suitability group: C

Mp—Mosher-Capa silt loams

Composition

Mosher and similar soils: 60 to 70 percent
Capa and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Terraces
Landform position: Mosher—foot slopes; Capa—the lower foot slopes
Slope range: Mosher—0 to 2 percent; Capa—0 to 1 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Typical Profile

Mosher

Surface layer:
0 to 3 inches—gray silt loam

Subsurface layer:
3 to 6 inches—light gray silt loam

Subsoil:
6 to 11 inches—dark grayish brown clay
11 to 25 inches—grayish brown, calcareous clay
25 to 40 inches—grayish brown, calcareous clay with masses of gypsum and other salts
40 to 60 inches—grayish brown, calcareous silty clay with masses of gypsum and other salts

Capa

Surface layer:
0 to 1 inch—light brownish gray silt loam

Subsoil:
1 to 4 inches—dark grayish brown clay
4 to 11 inches—dark grayish brown, calcareous clay
11 to 31 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
31 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: Mosher—3 to 5 feet; Capa—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Mosher—moderately low; Capa—low
Surface runoff: Mosher—medium; Capa—low
Other properties: Both soils have a sodium-affected subsoil.

Inclusions

Contrasting inclusions:
• The well drained Kirley soils, which do not have a sodium-affected subsoil; on back slopes
• The poorly drained and very poorly drained Kolls soils in basins
• Slickspots, which have salts at or near the surface; on the lower foot slopes

Use and Management

Cropland and pasture

Management considerations:
• The Mosher soil is poorly suited to cropland, and the Capa soil is unsuited to cropland.
Dominant use:
• Most of the acreage is used as pasture and rangeland.
Management concerns: A sodium-affected subsoil, which adversely affects plant growth by restricting root penetration; a slow rate of water intake

Management measures:
• Proper grazing management helps to maintain plant vigor and conserves moisture.
• If cultivated crops are grown, tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture.
• Rotations that include grasses and legumes and chiseling and subsoiling improve tilth and increase the rate of water infiltration.

Interpretive Groups

Land capability classification: Mosher—IVs-2; Capa—VIs-1
Range site: Mosher—Claypan; Capa—Thin Claypan
Windbreak suitability group: Mosher—9; Capa—10
Pasture suitability group: Mosher—C; Capa—NS

Nb—Nimbro silty clay loam (fig. 7)

Composition

Nimbro and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular or long and narrow
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 7 inches—grayish brown, calcareous silty clay loam

Underlying layer:
7 to 20 inches—light brownish gray, calcareous clay loam
20 to 60 inches—light brownish gray, calcareous, stratified clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: Rare
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes on fans or terraces
• The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Nimbro soil; in positions on the landscape similar to those of the Nimbro soil
• The moderately well drained Wendte soils, which contain more clay than the Nimbro soil; in positions on the landscape similar to those of the Nimbro soil
• The very poorly drained Albaton soils on low flood plains

Similar inclusions:
• Soils that contain less clay throughout than the Nimbro soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, forage sorghum, and alfalfa
Management concerns: Conserving moisture; wind erosion; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control wind erosion.

Interpretive Groups

Land capability classification: IIc-1
Range site: Loamy Terrace
Windbreak suitability group: 1
Pasture suitability group: F

Nc—Nimbro silty clay loam, channeled

Composition

Nimbro and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 50 to 1,000 acres

Figure 7.—An area of Nimbro silty clay loam used for tame pasture and hay.

Typical Profile

Surface layer:
0 to 7 inches—grayish brown, calcareous silty clay loam

Underlying layer:
7 to 20 inches—light brownish gray, calcareous clay loam
20 to 60 inches—light brownish gray, calcareous, stratified clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 3.5 to 5.0 feet
Flooding: Frequent for brief periods (fig. 8)
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Low
Other properties: A high content of lime; a flood plain that is dissected by a meandering channel

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes on fans or terraces
- The moderately well drained Hilmoe soils, which contain more clay in the upper part than the Nimbro soil; in positions on the landscape similar to those of the Nimbro soil
- The moderately well drained Wendte soils, which contain more clay than the Nimbro soil; on high flood plains

Similar inclusions:
- Soils that contain less clay throughout than the Nimbro soil

Figure 8.—This area of Nimbro silty clay loam, channeled, is frequently flooded by the Bad River.

Use and Management

Rangeland

Management concerns: Meandering channels; wetness; wind erosion; the high content of lime, which adversely affects the availability of plant nutrients

Management measures:

• Proper grazing management helps to maintain plant vigor.

Interpretive Groups

Land capability classification: VIw-1
Range site: Loamy Overflow
Windbreak suitability group: 1
Pasture suitability group: NS

OaF—Okaton silty clay, 25 to 60 percent slopes

Composition

Okaton and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Setting

Landform: Dissected plains
Landform position: Shoulder slopes and back slopes
Slope range: 25 to 60 percent
Shape of areas: Irregular
Size of areas: 40 to 600 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown, calcareous silty clay

Transitional layer:
2 to 8 inches—grayish brown, calcareous silty clay

Underlying layer:
8 to 14 inches—grayish brown, calcareous clay
14 to 60 inches—grayish brown and light brownish gray, calcareous shale

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Shallow
Depth to contrasting layer: 10 to 20 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None

Ponding: None
Permeability: Slow
Available water capacity: Very low
Organic matter content: Moderately low
Surface runoff: Very high
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
• The moderately deep Lakoma soils on the lower back slopes

Similar inclusions:
• Soils that contain a lower content of carbonates than the Okaton soil

Use and Management

Rangeland

Management concerns: Very low available water capacity; a slow rate of water intake; wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; slope; the formation of gullies along some cattle trails
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: VIIe-8
Range site: Shallow
Windbreak suitability group: 10
Pasture suitability group: NS

ObE—Okaton-Lakoma silty clays, 15 to 40 percent slopes

Composition

Okaton and similar soils: 45 to 55 percent
Lakoma and similar soils: 35 to 45 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Dissected plains
Landform position: Okaton—shoulder slopes and the upper back slopes; Lakoma—back slopes
Slope range: Okaton—15 to 40 percent; Lakoma—15 to 25 percent
Shape of areas: Irregular
Size of areas: 5 to 1,000 acres

Typical Profile

Okaton

Surface layer:
0 to 2 inches—grayish brown, calcareous silty clay

Transitional layer:
2 to 8 inches—grayish brown, calcareous silty clay

Underlying layer:
8 to 14 inches—grayish brown, calcareous clay
14 to 60 inches—grayish brown and light brownish gray, calcareous shale

Lakoma

Surface layer:
0 to 5 inches—dark grayish brown, calcareous silty clay

Subsoil:
5 to 10 inches—grayish brown, calcareous silty clay
10 to 26 inches—light brownish gray, calcareous silty clay

Underlying layer:
26 to 36 inches—light brownish gray, calcareous silty clay
36 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Okaton—shallow; Lakoma—moderately deep
Depth to contrasting layer: Okaton—10 to 20 inches over shale; Lakoma—20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Okaton—very low; Lakoma—low
Organic matter content: Moderately low
Surface runoff: Very high
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes

• The somewhat excessively drained Vivian soils, which have underlying gravelly material; on summits and shoulder slopes
• The stratified Wendte soils on high flood plains
• The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
• Soils that contain a lower content of carbonates throughout than the Okaton soil
• Soils that are similar to the Lakoma soil but have shale below a depth of 40 inches
• Soils that have a darker surface layer than that of the Lakoma soil

Use and Management

Rangeland

Management concerns: Okaton—very low available water capacity; a slow rate of water intake; wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; slope; the formation of gullies along some cattle trails; Lakoma—low available water capacity; a slow rate of water intake; wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; slope

Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: Okaton—VIIe-8; Lakoma—VIe-4
Range site: Okaton—Shallow; Lakoma—Thin Upland
Windbreak suitability group: Okaton—10; Lakoma—10
Pasture suitability group: Okaton—NS; Lakoma—NS

OkE—Okaton-Wendte-Bullcreek complex, 0 to 45 percent slopes (fig. 9)

Composition

Okaton and similar soils: 40 to 55 percent
Wendte and similar soils: 20 to 25 percent
Bullcreek and similar soils: 15 to 30 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Dissected plains and flood plains
Landform position: Okaton—shoulder slopes and back slopes; Wendte—high flood plains; Bullcreek—foot slopes
Slope range: Okaton—6 to 45 percent; Wendte—0 to 2 percent; Bullcreek—0 to 6 percent
Shape of areas: Long and narrow
Size of areas: 20 to 1,000 acres

Typical Profile

Okaton

Surface layer:
0 to 2 inches—grayish brown, calcareous silty clay

Transitional layer:
2 to 8 inches—grayish brown, calcareous silty clay

Underlying layer:
8 to 14 inches—grayish brown, calcareous clay
14 to 60 inches—grayish brown and light brownish gray, calcareous shale

Wendte

Surface layer:
0 to 6 inches—grayish brown, calcareous silty clay

Underlying layer:
6 to 47 inches—grayish brown, calcareous clay loam with thin strata of coarser textured material
47 to 60 inches—light brownish gray, calcareous clay loam with thin strata of coarser textured material

Bullcreek

Surface layer:
0 to 3 inches—grayish brown clay

Subsoil:
3 to 12 inches—grayish brown clay
12 to 25 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
25 to 60 inches—grayish brown and light brownish gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Okaton—well drained; Wendte—moderately well drained; Bullcreek—well drained
Depth to bedrock: Okaton—shallow; Wendte—very deep; Bullcreek—very deep
Depth to contrasting layer: Okaton—10 to 20 inches over shale; Wendte—more than 60 inches; Bullcreek—more than 60 inches
Depth to the high water table: Okaton—more than 6 feet; Wendte—3.5 to 5.0 feet; Bullcreek—more than 6 feet

Figure 9.—A woody draw in an area of Okaton-Wendte-Bullcreek complex, 0 to 45 percent slopes.

Flooding: Okaton—none; Wendte—occasional for brief periods; Bullcreek—none
Ponding: None
Permeability: Okaton—slow; Wendte—slow; Bullcreek—very slow
Available water capacity: Okaton—very low; Wendte—moderate; Bullcreek—moderate
Organic matter content: Okaton—moderately low; Wendte—moderate; Bullcreek—moderately low
Surface runoff: Okaton—very high; Wendte—medium; Bullcreek—medium
Other properties: Areas of the Wendte soil are dissected by a meandering channel. The Bullcreek soil has a high content of salts, and the Okaton and Wendte soils have a high content of lime.

Inclusions

Contrasting inclusions:
- The moderately deep, well drained Lakoma soils on the lower back slopes
- The moderately deep, well drained Opal soils, which are darker than the Lakoma soils; on the lower back slopes
- The deep and very deep, well drained Promise soils on the lower back slopes and on foot slopes
- The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
- Soils that contain a lower content of carbonates throughout than the Okaton soil

Use and Management

Rangeland

Management concerns: Okaton—very low available water capacity; a slow rate of water intake; wind erosion; water erosion; the high content of lime, which adversely affects the availability of plant nutrients; slope; the formation of gullies along some cattle trails; Wendte—wetness; wind erosion; the high content of lime, which adversely affects the availability of plant nutrients; a slow

rate of water intake; Bullcreek—a slow rate of water intake, a high concentration of salt, wind erosion

Management measures:

• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.

• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: Okaton—VIIe-8; Wendte—VIw-1; Bullcreek—VIs-5

Range site: Okaton—Shallow; Wendte—Clayey Overflow; Bullcreek—Dense Clay

Windbreak suitability group: Okaton—10; Wendte—4; Bullcreek—10

Pasture suitability group: Okaton—NS; Wendte—NS; Bullcreek—NS

OlB—Opal clay loam, 3 to 6 percent slopes

Composition

Opal and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Back slopes
Slope range: 3 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay loam

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: High

Inclusions

Contrasting inclusions:

• The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:

• Soils that contain more clay in the surface layer than the Opal soil

• Soils that do not have bedded shale within a depth of 40 inches

• Soils that contain more carbonates throughout than the Opal soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa

Management concerns: Water erosion, a slow rate of water intake, low available water capacity

Management measures:

• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control erosion.

• Contour farming, grassed waterways, stripcropping, and field windbreaks help to control erosion.

• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

OlC—Opal clay loam, 6 to 9 percent slopes

Composition

Opal and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Shoulder slopes and back slopes
Slope range: 6 to 9 percent

Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay loam

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Very high

Inclusions

Contrasting inclusions:
• The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
• Soils that contain more clay in the surface layer than the Opal soil
• Soils that do not have bedded shale within a depth of 40 inches
• Soils that contain more carbonates throughout than the Opal soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Water erosion, a slow rate of water intake, low available water capacity
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control erosion.
• Contour farming, terraces, stripcropping, field windbreaks, and grassed waterways help to control erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IVe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

OID—Opal clay loam, 6 to 15 percent slopes

Composition

Opal and similar soils: 80 to 85 percent
Contrasting inclusions: 15 to 20 percent

Setting

Landform: Dissected plains
Landform position: Shoulder slopes and back slopes
Slope range: 6 to 15 percent
Shape of areas: Irregular
Size of areas: 5 to 75 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay loam

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Very high

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which

have visible salts within a depth of 20 inches; on foot slopes
• The very deep, very poorly drained Herdcamp soils on low flood plains
• The shallow Okaton soils on shoulder slopes

Similar inclusions:
• Soils that contain more clay in the surface layer than the Opal soil
• Soils that do not have bedded shale within a depth of 40 inches
• Soils that contain more carbonates throughout than the Opal soil

Use and Management

Rangeland

Management concerns: Water erosion, a slow rate of water intake, low available water capacity, the formation of gullies along some cattle trails
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: VIe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

OpA—Opal clay, 0 to 3 percent slopes

Composition

Opal and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Summits and back slopes
Slope range: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The very deep, moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
• The very deep, moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes
• The poorly drained and very poorly drained Kolls soils in basins

Similar inclusions:
• Soils that do not have bedded shale within a depth of 40 inches
• Soils that have a lighter colored surface layer than that of the Opal soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion, a slow rate of water intake, low available water capacity
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.
• Stripcropping and field windbreaks also help to control wind erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

OpB—Opal clay, 3 to 6 percent slopes

Composition

Opal and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Back slopes
Slope range: 3 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 800 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: High

Inclusions

Contrasting inclusions:
• The very deep, moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
• The very deep, moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes
• The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
• Soils that do not have bedded shale within a depth of 40 inches
• Soils that have a lighter colored surface layer than that of the Opal soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion, water erosion, a slow rate of water intake, low available water capacity
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control erosion.
• Contour farming, grassed waterways, stripcropping, and field windbreaks help to control erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

OpC—Opal clay, 6 to 9 percent slopes (fig. 10)

Composition

Opal and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Dissected plains
Landform position: Back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 1,000 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Figure 10.—An area of Opal clay, 6 to 9 percent slopes, used as hayland.

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Very high

Inclusions

Contrasting inclusions:
- The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
- The very deep, moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
- The shallow, well drained Sansarc soils on shoulder slopes
- The very deep, very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
- Soils that do not have bedded shale within a depth of 40 inches
- Soils that have a lighter colored surface layer than that of the Opal soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion, water erosion, a slow rate of water intake, low available water capacity, the formation of gullies along some cattle trails
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control erosion.
- Contour farming, terraces, grassed waterways, stripcropping, and field windbreaks help to control erosion.
- Chiseling and subsoiling when the soil is dry

improve tilth and increase the rate of water infiltration.
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: IVe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

OpD—Opal clay, 6 to 15 percent slopes

Composition

Opal and similar soils: 75 to 90 percent
Contrasting inclusions: 10 to 25 percent

Setting

Landform: Dissected plains
Landform position: Summits and back slopes
Slope range: 6 to 15 percent
Shape of areas: Irregular
Size of areas: 15 to 1,000 acres

Typical Profile

Surface layer:
0 to 2 inches—grayish brown clay

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, mottled, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray, mottled shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Moderately deep
Depth to contrasting layer: 20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Very high

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes
• The very deep, moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
• The very deep, very poorly drained Herdcamp soils on low flood plains
• The shallow, well drained Sansarc soils on back slopes

Similar inclusions:
• Soils that have a lighter colored surface layer than that of the Opal and Sansarc soils
• Soils that do not have bedded shale within a depth of 40 inches

Use and Management

Rangeland

Management concerns: Wind erosion, water erosion, a slow rate of water intake, low available water capacity, the formation of gullies along some cattle trails
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: VIe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

Ot—Orthents, gravelly

Composition

Orthents and similar soils: 95 to 99 percent
Contrasting inclusions: 1 to 5 percent

Setting

Landform: Terraces
Landform position: Excavations and spoil
Slope range: 0 to 60 percent
Shape of areas: Irregular
Size of areas: 5 to 25 acres

Description of the Orthents

These soils are gravel pits. The surface layer ranges

from gravelly material to shaly material. Some areas are excavated to the underlying shaly material.

Soil Properties and Qualities

Drainage class: Excessively drained
Depth to bedrock: Shallow
Depth to contrasting layer: 0 to 10 inches over gravelly material
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid over very slow
Available water capacity: Very low
Organic matter content: Low
Surface runoff: Low

Inclusions

Contrasting inclusions:
• The shallow, well drained Okaton and Sansarc soils on shoulder slopes
• The somewhat excessively drained Vivian soils, which have underlying gravelly material; on summits and shoulder slopes

Use and Management

Dominant land use:
• Most areas are gravel pits used mainly as a source of sand and gravel for construction purposes. Some areas provide limited wildlife habitat.

Rangeland

Management concerns: Very low available water capacity, low fertility, shallow depth to bedrock
Management measures:
• Abandoned gravel pits can be restored to rangeland or tame pasture if reclamation measures are applied.
• Shaping the area can reduce the slope. Mounds of overburden can be used as topsoil dressing.
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Applying fertilizer as needed helps to establish range or pasture plants.

Interpretive Groups

Land capability classification: VIIIs-1
Range site: Not assigned
Windbreak suitability group: 10
Pasture suitability group: NS

PrA—Promise clay, 0 to 3 percent slopes (fig. 11)

Composition

Promise and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Plains
Landform position: The lower back slopes and foot slopes
Slope range: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 5 to 1,500 acres

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, calcareous clay

Subsoil:
5 to 20 inches—dark grayish brown and grayish brown, calcareous clay
20 to 34 inches—grayish brown, calcareous clay

Underlying layer:
34 to 40 inches—grayish brown, calcareous clay
40 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Deep and very deep
Depth to contrasting layer: 40 to more than 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The moderately well drained Capa soils, which have a sodium-affected subsoil; on the lower foot slopes
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on the lower foot slopes
• The poorly drained and very poorly drained Kolls soils in basins
• The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes

Figure 11.—An area of Promise clay, 0 to 3 percent slopes, in the foreground. Lakoma silty clay, 6 to 15 percent slopes, is in the background.

Similar inclusions:
- Soils that have shale within a depth of 40 inches
- Soils that contain less clay than the Promise soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion, a slow rate of water intake
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.
- Stripcropping and field windbreaks also help to control wind erosion.
- Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

PrB—Promise clay, 3 to 6 percent slopes

Composition

Promise and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Plains
Landform position: The lower back slopes and foot slopes
Slope range: 3 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 1,200 acres

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, calcareous clay

Subsoil:
5 to 20 inches—dark grayish brown and grayish brown, calcareous clay
20 to 34 inches—grayish brown, calcareous clay

Underlying layer:
34 to 40 inches—grayish brown, calcareous clay
40 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Deep and very deep
Depth to contrasting layer: 40 to more than 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: High

Inclusions

Contrasting inclusions:
• The moderately well drained Capa soils, which have a sodium-affected subsoil; on the lower foot slopes
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on the lower foot slopes
• The poorly drained and very poorly drained Kolls soils in basins
• The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes

Similar inclusions:
• Soils that have shale within a depth of 40 inches
• Soils that contain less clay than the Promise soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion, water erosion, a slow rate of water intake
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control erosion.
• Contour farming, grassed waterways, stripcropping, and field windbreaks help to control erosion.
• Chiseling or subsoiling improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

PrC—Promise clay, 6 to 9 percent slopes

Composition

Promise and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Setting

Landform: Plains
Landform position: The lower back slopes and foot slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 250 acres

Typical Profile

Surface layer:
0 to 5 inches—dark grayish brown, calcareous clay

Subsoil:
5 to 20 inches—dark grayish brown and grayish brown, calcareous clay
20 to 34 inches—grayish brown, calcareous clay

Underlying layer:
34 to 40 inches—grayish brown, calcareous clay
40 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Deep and very deep
Depth to contrasting layer: 40 to more than 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Very high

Inclusions

Contrasting inclusions:
• The moderately well drained Capa soils, which have a sodium-affected subsoil; on the lower foot slopes
• The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on the lower foot slopes
• The shallow, well drained Sansarc soils on shoulder slopes

Similar inclusions:
• Soils that have shale within a depth of 40 inches

- Soils that contain less clay than the Promise soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion, water erosion, a slow rate of water intake
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control erosion.
- Contour farming, terraces, grassed waterways, stripcropping, and field windbreaks help to control erosion.
- Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IVe-4
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

PsA—Promise-Bullcreek clays

Composition

Promise and similar soils: 40 to 65 percent
Bullcreek and similar soils: 25 to 40 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Plains
Landform position: Promise—the lower back slopes and foot slopes; Bullcreek—foot slopes
Slope range: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 10 to 400 acres

Typical Profile

Promise

Surface layer:
0 to 5 inches—dark grayish brown, calcareous clay

Subsoil:
5 to 20 inches—dark grayish brown and grayish brown, calcareous clay
20 to 34 inches—grayish brown, calcareous clay

Underlying layer:
34 to 40 inches—grayish brown, calcareous clay
40 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Bullcreek

Surface layer:
0 to 3 inches—grayish brown clay

Subsoil:
3 to 12 inches—grayish brown clay
12 to 25 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
25 to 60 inches—grayish brown and light brownish gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Promise—deep and very deep; Bullcreek—very deep
Depth to contrasting layer: Promise—40 to more than 60 inches over shale; Bullcreek—more than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Promise—moderate; Bullcreek—moderately low
Surface runoff: Medium
Other properties: A high content of salts in the Bullcreek soil

Inclusions

Contrasting inclusions:
- The moderately well drained Capa soils, which have a sodium-affected subsoil; in positions on the landscape similar to those of the Bullcreek soil
- The poorly drained and very poorly drained Kolls soils in basins
- The moderately deep, well drained Lakoma soils on the upper back slopes
- The shallow, well drained Okaton soils on shoulder slopes and the upper back slopes

Similar inclusions:
- Soils that have shale within a depth of 40 inches
- Soils that contain less clay in the subsoil than the Promise soil

Use and Management

Cropland and pasture

Management considerations:
- The Bullcreek soil is unsuited to cropland.

Main crops: Winter wheat and alfalfa
Management concerns: Promise—wind erosion, a slow rate of water intake; Bullcreek—a slow rate of water intake, a high concentration of salt, wind erosion
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.
- Stripcropping and field windbreaks also help to control wind erosion.
- Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: Promise—IIIs-3; Bullcreek—VIs-5
Range site: Promise—Clayey; Bullcreek—Dense Clay
Windbreak suitability group: Promise—4; Bullcreek—10
Pasture suitability group: Promise—I; Bullcreek—NS

PtA—Promise-Bullcreek-Kolls complex

Composition

Promise and similar soils: 40 to 50 percent
Bullcreek and similar soils: 20 to 35 percent
Kolls and similar soils: 10 to 15 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Plains
Landform position: Promise—the lower back slopes and foot slopes; Bullcreek—foot slopes; Kolls—basins
Slope range: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Promise

Surface layer:
0 to 5 inches—dark grayish brown, calcareous clay

Subsoil:
5 to 20 inches—dark grayish brown and grayish brown, calcareous clay
20 to 34 inches—grayish brown, calcareous clay

Underlying layer:
34 to 40 inches—grayish brown, calcareous clay
40 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Bullcreek

Surface layer:
0 to 3 inches—grayish brown clay

Subsoil:
3 to 12 inches—grayish brown clay
12 to 25 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
25 to 60 inches—grayish brown and light brownish gray, calcareous clay with masses of gypsum and other salts

Kolls

Surface layer:
0 to 3 inches—dark gray, calcareous silty clay

Subsoil:
3 to 12 inches—dark gray, calcareous clay
12 to 23 inches—gray, calcareous clay
23 to 31 inches—gray, calcareous clay

Underlying layer:
31 to 42 inches—gray, calcareous clay with masses of gypsum and other salts
42 to 60 inches—olive gray, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Promise—well drained; Bullcreek—well drained; Kolls—poorly drained
Depth to bedrock: Promise—deep and very deep; Bullcreek—very deep; Kolls—very deep
Depth to contrasting layer: Promise—40 to more than 60 inches over shale; Bullcreek—more than 60 inches; Kolls—more than 60 inches
Depth to the high water table: Promise—more than 6 feet; Bullcreek—more than 6 feet; Kolls—0 to 1.5 feet
Flooding: None
Ponding: Promise—none; Bullcreek—none; Kolls—frequent for long periods
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Promise—moderate; Bullcreek—moderately low; Kolls—moderate
Surface runoff: Promise—medium; Bullcreek—medium; Kolls—negligible
Other properties: A high content of salts in the Bullcreek soil

Inclusions

Contrasting inclusions:
• The well drained Kirley soils, which contain less clay throughout than the major soils; on the upper back slopes
• The moderately deep, well drained Lakoma soils on the upper back slopes

Use and Management

Cropland and pasture

Management considerations:
• The Bullcreek and Kolls soils are unsuited to cropland.
Main crops: Winter wheat and grain sorghum
Management concerns: Promise—wind erosion, a slow rate of water intake; Bullcreek—a slow rate of water intake, a high concentration of salt, wind erosion; Kolls—wetness, surface compaction during wet periods
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.
• Stripcropping and field windbreaks also help to control wind erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: Promise—IIIs-3; Bullcreek—VIs-5; Kolls—Vw-4
Range site: Promise—Clayey; Bullcreek—Dense Clay; Kolls—Closed Depression
Windbreak suitability group: Promise—4; Bullcreek—10; Kolls—10
Pasture suitability group: Promise—I; Bullcreek—NS; Kolls—B2

Pu—Promise-Capa complex

Composition

Promise and similar soils: 55 to 65 percent
Capa and similar soils: 20 to 35 percent
Contrasting inclusions: 10 to 15 percent

Setting

Landform: Plains
Landform position: Promise—foot slopes; Capa—the lower foot slopes
Slope range: Promise—0 to 3 percent; Capa—0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Promise

Surface layer:
0 to 5 inches—dark grayish brown, calcareous clay

Subsoil:
5 to 20 inches—dark grayish brown and grayish brown, calcareous clay
20 to 34 inches—grayish brown, calcareous clay

Underlying layer:
34 to 40 inches—grayish brown, calcareous clay
40 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Capa

Surface layer:
0 to 1 inch—light brownish gray silt loam

Subsoil:
1 to 4 inches—dark grayish brown clay
4 to 11 inches—dark grayish brown, calcareous clay
11 to 31 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Underlying layer:
31 to 60 inches—grayish brown, calcareous clay with masses of gypsum and other salts

Soil Properties and Qualities

Drainage class: Promise—well drained; Capa—moderately well drained
Depth to bedrock: Promise—deep and very deep; Capa—very deep
Depth to contrasting layer: Promise—40 to more than 60 inches over shale; Capa—more than 60 inches
Depth to the high water table: Promise—more than 6 feet; Capa—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: Promise—moderate; Capa—low
Surface runoff: Promise—medium; Capa—low
Other properties: The Capa soil has a sodium-affected subsoil.

Inclusions

Contrasting inclusions:
• The well drained Bullcreek soils, which do not have a sodium-affected subsoil; in positions on the landscape similar to those of the Capa soil

• The poorly drained and very poorly drained Kolls soils in basins
• The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes

Similar inclusions:
• Soils that contain less clay in the subsoil than the Promise soil

Use and Management

Cropland and pasture

Management considerations:
• The Capa soil is unsuited to cropland.
Main crops: Winter wheat and alfalfa
Management concerns: Promise—wind erosion, a slow rate of water intake; Capa—a sodium-affected subsoil, which adversely affects plant growth by restricting root penetration; a slow rate of water intake
Management measures:
• Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.
• Stripcropping and field windbreaks also help to control wind erosion.
• Chiseling or subsoiling when the soil is dry improves tilth and increases the rate of water infiltration.

Interpretive Groups

Land capability classification: Promise—IIIs-3; Capa—VIs-1
Range site: Promise—Clayey; Capa—Thin Claypan
Windbreak suitability group: Promise—4; Capa—10
Pasture suitability group: Promise—I; Capa—NS

ReA—Ree loam, 0 to 2 percent slopes

Composition

Ree and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Terraces
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 15 to 250 acres

Typical Profile

Surface layer:
0 to 7 inches—dark grayish brown loam

Subsoil:
7 to 13 inches—dark grayish brown clay loam
13 to 23 inches—grayish brown, calcareous clay loam
23 to 42 inches—light brownish gray, calcareous clay loam

Underlying layer:
42 to 60 inches—light yellowish brown, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Low

Inclusions

Contrasting inclusions:
• The moderately well drained Mosher soils, which have a sodium-affected subsoil; on foot slopes
• The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes
• The poorly drained Hoven soils in basins

Similar inclusions:
• Soils that contain more clay in the subsoil than the Ree soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Few limitations, except conserving moisture
Management measures:
• Managing crop residue helps to conserve moisture and helps to maintain the content of organic matter and tilth.

Interpretive Groups

Land capability classification: IIc-2
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

ReB—Ree loam, 2 to 6 percent slopes

Composition

Ree and similar soils: 85 to 99 percent

Contrasting inclusions: 1 to 15 percent

Setting

Landform: Terraces
Landform position: Back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 15 to 150 acres

Typical Profile

Surface layer:
0 to 7 inches—dark grayish brown loam

Subsoil:
7 to 13 inches—dark grayish brown clay loam
13 to 23 inches—grayish brown, calcareous clay loam
23 to 42 inches—light brownish gray, calcareous clay loam

Underlying layer:
42 to 60 inches—light yellowish brown, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
- The moderately well drained Mosher soils, which have a sodium-affected subsoil; on foot slopes
- The moderately well drained Witten soils, which are dark to a depth of more than 20 inches; on foot slopes
- The poorly drained Hoven soils in basins

Similar inclusions:
- Soils that contain more clay in the subsoil than the Ree soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Water erosion
Management measures:
- Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control water erosion.
- Stripcropping, field windbreaks, contour farming, and grassed waterways also help to control water erosion.

Interpretive Groups

Land capability classification: IIe-1
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

ReC—Ree loam, 6 to 9 percent slopes

Composition

Ree and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Terraces
Landform position: Shoulder slopes and back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 7 inches—dark grayish brown loam

Subsoil:
7 to 13 inches—dark grayish brown clay loam
13 to 23 inches—grayish brown, calcareous clay loam
23 to 42 inches—light brownish gray, calcareous clay loam

Underlying layer:
42 to 60 inches—light yellowish brown, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
- The moderately deep Lakoma soils, which contain more clay than the Ree soil; on the upper back slopes
- The somewhat excessively drained Vivian soils,

which have underlying gravelly material; on summits and shoulder slopes

Similar inclusions:
• Soils that contain more clay in the subsoil than the Ree soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Water erosion
Management measures:
• Tilling in a timely manner, minimizing tillage, and leaving crop residue on the surface help to conserve moisture and control water erosion.
• Stripcropping, contour farming, terraces, and grassed waterways also help to control water erosion.

Interpretive Groups

Land capability classification: IIIe-1
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

SaE—Sansarc clay, 15 to 40 percent slopes

Composition

Sansarc and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Dissected plains
Landform position: Shoulder slopes and back slopes
Slope range: 15 to 40 percent
Shape of areas: Irregular
Size of areas: 15 to 200 acres

Typical Profile

Surface layer:
0 to 3 inches—olive gray, calcareous clay

Transitional layer:
3 to 10 inches—olive gray, calcareous clay

Underlying layer:
10 to 14 inches—light olive gray, calcareous clay
14 to 60 inches—light olive gray, calcareous shale

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Shallow
Depth to contrasting layer: 10 to 20 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Very low
Organic matter content: Low
Surface runoff: Very high
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes along drainageways
• The moderately deep, well drained Opal soils on the lower back slopes
• The somewhat excessively drained Vivian soils, which have underlying gravelly material; on summits and shoulder slopes
• Areas of Rock outcrop, which are exposures of shale bedrock; on shoulder slopes and back slopes

Similar inclusions:
• Soils that contain more carbonates throughout than the Sansarc soil

Use and Management

Rangeland

Management concerns: Wind erosion; water erosion; slope; a slow rate of water intake; very low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: VIIe-8
Range site: Shallow Clay
Windbreak suitability group: 10
Pasture suitability group: NS

SoE—Sansarc-Opal clays, 9 to 40 percent slopes

Composition

Sansarc and similar soils: 40 to 75 percent
Opal and similar soils: 20 to 40 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Dissected plains
Landform position: Sansarc—shoulder slopes and the upper back slopes; Opal—back slopes
Slope range: Sansarc—15 to 40 percent; Opal—9 to 25 percent
Shape of areas: Irregular
Size of areas: 25 to 2,000 acres

Typical Profile

Sansarc

Surface layer:
0 to 3 inches—olive gray, calcareous clay

Transitional layer:
3 to 10 inches—olive gray, calcareous clay

Underlying layer:
10 to 14 inches—light olive gray, calcareous clay
14 to 60 inches—light olive gray, calcareous shale

Opal

Surface layer:
0 to 2 inches—grayish brown clay

Subsoil:
2 to 16 inches—grayish brown, calcareous clay
16 to 26 inches—light brownish gray, calcareous clay

Underlying layer:
26 to 35 inches—light brownish gray, calcareous clay with masses of gypsum and other salts
35 to 60 inches—light brownish gray and dark gray shale; calcareous in the upper part

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Sansarc—shallow; Opal—moderately deep
Depth to contrasting layer: Sansarc—10 to 20 inches over shale; Opal—20 to 40 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Sansarc—slow; Opal—very slow
Available water capacity: Sansarc—very low; Opal—low
Organic matter content: Sansarc—low; Opal—moderate
Surface runoff: Very high
Other properties: A high content of lime in the Sansarc soil

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes along drainageways
• The moderately well drained Capa soils, which have a sodium-affected subsoil; on foot slopes
• Areas of Rock outcrop, which are exposures of shale bedrock; on shoulder slopes and back slopes
• Slickspots, which have salts at or near the surface; on foot slopes

Similar inclusions:
• Soils that contain more carbonates than the Sansarc and Opal soils
• Soils that do not have shale within a depth of 40 inches

Use and Management

Rangeland

Management concerns: Sansarc—wind erosion; water erosion; slope; a slow rate of water intake; very low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails; Opal—wind erosion, water erosion, a slow rate of water intake, low available water capacity, the formation of gullies along some cattle trails
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: Sansarc—VIIe-8; Opal—VIe-4
Range site: Sansarc—Shallow Clay; Opal—Clayey
Windbreak suitability group: Sansarc—10; Opal—10
Pasture suitability group: Sansarc—NS; Opal—NS

SrE—Sansarc-Rock outcrop complex, 9 to 60 percent slopes

Composition

Sansarc and similar soils: 50 to 70 percent
Rock outcrop and similar inclusions: 20 to 35 percent
Contrasting inclusions: 5 to 10 percent

Setting

Landform: Dissected plains
Landform position: Sansarc—summits, shoulder slopes, and the upper back slopes; Rock outcrop—back slopes
Slope range: Sansarc—15 to 40 percent; Rock outcrop—9 to 60 percent
Shape of areas: Long and narrow or irregular
Size of areas: 20 to 100 acres

Typical Profile

Sansarc

Surface layer:
0 to 3 inches—olive gray, calcareous clay

Transitional layer:
3 to 10 inches—olive gray, calcareous clay

Underlying layer:
10 to 14 inches—light olive gray, calcareous clay
14 to 60 inches—light olive gray, calcareous shale

Rock outcrop

Rock outcrop consists of eroding exposures of soft bedrock.
Rock outcrop is barren of vegetation.
In some places, 1 to 5 inches of loose, weathered material is on the surface.

Soil Properties and Qualities

Drainage class: Sansarc—well drained; Rock outcrop—not assigned
Depth to bedrock: Sansarc—shallow; Rock outcrop—not assigned
Depth to contrasting layer: Sansarc—10 to 20 inches over shale; Rock outcrop—soft bedrock at the surface
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Sansarc—slow; Rock outcrop—very slow
Available water capacity: Very low
Organic matter content: Low
Surface runoff: Very high
Other properties: A high content of lime in the Sansarc soil

Inclusions

Contrasting inclusions:
• The very deep, well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on foot slopes along drainageways
• The moderately deep, well drained Opal soils on the lower back slopes

Similar inclusions:
• Soils that contain more carbonates than the Sansarc soil

Use and Management

Rangeland

Management concerns: Sansarc—wind erosion; water erosion; slope; a slow rate of water intake; very low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails; Rock outcrop—exposed areas of bedrock
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: Sansarc—VIIe-8; Rock outcrop—VIIIs-1
Range site: Sansarc—Shallow Clay; Rock outcrop—Not assigned
Windbreak suitability group: Sansarc—10; Rock outcrop—10
Pasture suitability group: Sansarc—NS; Rock outcrop—NS

SvE—Sansarc-Vivian complex, 9 to 40 percent slopes

Composition

Sansarc and similar soils: 55 to 70 percent
Vivian and similar soils: 20 to 40 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Dissected plains
Landform position: Sansarc—back slopes; Vivian—summits and shoulder slopes
Slope range: Sansarc—9 to 40 percent; Vivian—15 to 40 percent
Shape of areas: Irregular
Size of areas: 10 to 80 acres

Typical Profile

Sansarc

Surface layer:
0 to 3 inches—olive gray, calcareous clay

Transitional layer:
3 to 10 inches—olive gray, calcareous clay

Underlying layer:
10 to 14 inches—light olive gray, calcareous clay
14 to 60 inches—light olive gray, calcareous shale

Vivian

Surface layer:
0 to 4 inches—grayish brown, calcareous gravelly loam

Underlying layer:
4 to 50 inches—pale brown, calcareous very gravelly loam
50 to 60 inches—pale yellow, calcareous shale

Soil Properties and Qualities

Drainage class: Sansarc—well drained; Vivian—somewhat excessively drained
Depth to bedrock: Sansarc—shallow; Vivian—deep
Depth to contrasting layer: Sansarc—10 to 20 inches over shale; Vivian—40 to 60 inches over shale
Depth to the high water table: More than 6 feet
Flooding: None
Ponding: None
Permeability: Sansarc—slow; Vivian—moderately rapid above the shale
Available water capacity: Sansarc—very low; Vivian—low
Organic matter content: Low
Surface runoff: Very high
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
- The very deep, well drained Kirley soils, which contain less clay throughout than the Sansarc soil; on summits on terraces
- The moderately deep, well drained Lakoma and Opal soils on the lower back slopes

Similar inclusions:
- Soils that contain more carbonates than the Sansarc soil

Use and Management

Rangeland

Management concerns: Sansarc—wind erosion; water erosion; slope; a slow rate of water intake; very low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails; Vivian—wind erosion; water erosion; a slow rate of water intake; slope; low available water capacity; the high content of lime, which adversely affects the availability of plant nutrients; the formation of gullies along some cattle trails

Management measures:
- Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
- Fencing and other means of controlling livestock traffic patterns help to prevent the formation of gullies.

Interpretive Groups

Land capability classification: Sansarc—VIIe-8; Vivian—VIe-5
Range site: Sansarc—Shallow Clay; Vivian—Thin Upland
Windbreak suitability group: Sansarc—10; Vivian—10
Pasture suitability group: Sansarc—NS; Vivian—NS

Wc—Wendte silty clay

Composition

Wendte and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 10 to 150 acres

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, calcareous silty clay

Underlying layer:
6 to 47 inches—grayish brown, calcareous clay loam with thin strata of coarser textured material
47 to 60 inches—light brownish gray, calcareous clay loam with thin strata of coarser textured material

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 3.5 to 5.0 feet
Flooding: Rare
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Low
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on adjacent foot slopes on fans or terraces
- The moderately well drained Capa soils, which have a sodium-affected subsoil; on adjacent foot slopes on fans or terraces
- The well drained Promise soils on adjacent foot slopes on plains

Similar inclusions:
- Soils that have silty material within a depth of 40 inches

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, and alfalfa
Management concerns: Wind erosion; a slow rate of water intake; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture, control wind erosion, maintain fertility, and improve tilth.
- Stripcropping and field windbreaks help to control wind erosion.
- Chiseling and subsoiling when the soil is dry increase the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Clayey Overflow
Windbreak suitability group: 4
Pasture suitability group: I

Wd—Wendte silty clay, channeled

Composition

Wendte and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 10 to 150 acres

Typical Profile

Surface layer:
0 to 6 inches—grayish brown, calcareous silty clay

Underlying layer:
6 to 47 inches—grayish brown, calcareous clay loam with thin strata of coarser textured material
47 to 60 inches—light brownish gray, calcareous clay loam with thin strata of coarser textured material

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 3.5 to 5.0 feet
Flooding: Occasional for brief periods
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Low
Other properties: A flood plain that typically is dissected by a meandering channel; a high content of lime

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; on adjacent foot slopes on fans or terraces
- The moderately well drained Capa soils, which have a sodium-affected subsoil; on adjacent foot slopes on fans or terraces
- The very poorly drained Herdcamp soils on low flood plains

Similar inclusions:
- Soils that have silty material within a depth of 40 inches

Use and Management

Rangeland

Management concerns: Meandering channels; wetness; wind erosion; a slow rate of water intake; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
- Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.

Interpretive Groups

Land capability classification: VIw-1

Range site: Clayey Overflow
Windbreak suitability group: 4
Pasture suitability group: NS

Wt—Witten silty clay

Composition

Witten and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Plains
Landform position: Foot slopes
Slope range: 0 to 3 percent
Shape of areas: Long and narrow or irregular
Size of areas: 5 to 175 acres

Typical Profile

Surface soil:
0 to 12 inches—dark gray, calcareous silty clay and clay

Subsoil:
12 to 32 inches—dark gray, calcareous clay
32 to 49 inches—grayish brown, calcareous clay

Underlying layer:
49 to 60 inches—grayish brown, calcareous clay

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: More than 60 inches
Depth to the high water table: 3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Medium
Other properties: The soil has a high content of lime. Runoff water flows over the soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
- The well drained Bullcreek soils, which have visible salts within a depth of 20 inches; in positions on the landscape similar to those of the Witten soil
- The poorly drained and very poorly drained Kolls soils in basins
- The well drained Millboro soils, which are dark to a depth of less than 20 inches; on back slopes
- The well drained Promise soils, which contain more clay than the Witten soil; on the lower back slopes and foot slopes

Similar inclusions:
- Soils that contain less clay in the surface layer than the Witten soil

Use and Management

Cropland

Main crops: Winter wheat, grain sorghum, oats, and alfalfa
Management concerns: Wind erosion; a slow rate of water intake; the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
- Tilling in a timely manner, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.
- Stripcropping and field windbreaks help to control wind erosion.
- Chiseling and subsoiling when the soil is dry improve tilth and increase the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Clayey Overflow
Windbreak suitability group: 4
Pasture suitability group: I

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and

economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 1,000 acres in the survey area, or less than 1 percent of the total acreage, meets the soil requirements for prime farmland. This land is in the southern part of the county along the White River in association 2, which is described under the heading "General Soil Map Units." All of this prime farmland is irrigated and used for crops. The crops grown on this land are mainly corn and alfalfa. About 79,500 additional acres would meet the requirements for prime farmland if irrigated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that receive an inadequate amount of rainfall qualify as prime farmland only in areas where this limitation has been overcome by irrigation. The need for irrigation is indicated after all of the map unit names in table 5. Onsite evaluation is needed to determine whether or not a specific area is irrigated.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the county are assigned to various interpretive groups at the end of each map unit description. The groups for each map unit also are shown under the heading "Interpretive Groups," which follows the tables at the back of this survey.

Crops

Jeffrey Hemenway, conservation agronomist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crop production is suggested in this section. The crops best suited to the soils in the survey area are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the South Dakota Cooperative Extension Service.

About 34 percent of the acreage in Jones County is used for cultivated crops *(11)*. The major crops are winter wheat, grain sorghum, forage sorghum, spring wheat, oats, and alfalfa. Barley, corn, and sunflowers are also grown. Winter wheat, grain sorghum, spring wheat, and sunflowers are grown as cash grain crops. Oats, barley, and corn are grown as cash crops and for livestock feed. Alfalfa and forage sorghum are harvested mainly for hay. Oats are also harvested as a forage.

The soils in the county have a good potential for increased crop production. Crop production could be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the county.

Water erosion reduces productivity and results in sedimentation. Water erosion is a hazard on such soils as Lakoma, Opal, Promise, and other soils if the slope is more than 2 percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the

surface layer is especially damaging on soils that have a thin surface layer, such as Vivian soils. When erosion occurs, sediment rich in nutrients enters streams, stock dams, lakes, and reservoirs. Measures that control erosion minimize this pollution and preserve water quality for livestock and for fish and other wildlife and for recreational uses. These measures also reduce the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients and pesticides that have been applied to the soil.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential (fig. 12). Minimizing tillage and leaving crop residue on the surface increase the water infiltration rate, reduce the runoff rate, and help to control erosion. Conservation tillage is a form of noninversion tillage that retains protective amounts of crop residue on the surface throughout the year. This practice is effective in controlling wind and water erosion. Conservation tillage includes no-till, strip-till, stubble mulching, and chemical fallow systems that have a minimum number of tillage operations. Crop residue that is left standing during the winter traps and holds snow until it melts and thus provides additional moisture to the soil.

Terraces and diversions help to control erosion by reducing the runoff rate and the length of slope. They are most practical on very deep and deep, well drained soils that have long, smooth slopes, such as Millboro and Promise soils. Many of the soils in the county, however, are poorly suited to terraces and diversions because they have short, irregular slopes. On some soils, such as Opal and Lakoma soils, an unfavorable subsoil would be exposed in terrace channels. Grassed waterways are effective in controlling gully erosion in areas of concentrated flow.

Wind erosion is a slight to severe hazard on many of the soils in the county. The hazard is especially severe on those soils that have a surface layer of fine sandy loam or loamy fine sand, such as Bigbend and Inavale soils. Soils that have a high content of clay in the surface layer, such as Bullcreek, Opal, and Promise soils, also are susceptible to wind erosion. These soils can be damaged in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. Wind erosion can be controlled by an adequate plant cover, a cover of crop residue, stripcropping, and tillage methods that keep the surface rough. Establishing windbreaks of suitable trees and shrubs and leaving strips of unharvested crops also are effective in controlling wind erosion.

Information about measures that control erosion on each type of soil is contained in the South Dakota Technical Guide, which is available in the local office of the Natural Resources Conservation Service.

Soil fertility helps to determine the yields that can be obtained from the soil. A good nutrient management program can help to ensure the nutrients needed by the specific crop and optimize crop yields. The amount and type of fertilizer needed on soils that have a high content of lime in the surface layer, such as Bigbend and Lakoma soils, generally differ from the amount and type of nutrients needed on soils that do not have lime in the surface layer. A nutrient management plan should be based on the type of soil, available moisture, the crop selected for planting, a realistic goal for yields, current test levels of soil fertility, whether or not legumes have been planted in either of the last 2 years, whether or not agricultural waste has been applied, and the chance of pollution of surface water or ground water by nutrients from the site. The plan should be developed annually and record the amount of each nutrient needed, the form or forms of nutrients to apply, the site of application, the time of application, and the method of application. The Natural Resources Conservation Service, South Dakota Cooperative Extension Service, or the South Dakota Agricultural Experiment Station can help in developing a nutrient management plan.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. Management can maintain or improve the tilth of a specific soil. Managing a soil for good tilth generally increases the water infiltration rate and the available water capacity and provides a better environment for seedling emergence and root development. Such management has a positive effect on crop yield when compared to the same soil with poor management. If tilth is improved, less horsepower is required for tillage equipment.

Soil compaction is also an important factor affecting the use and management of the soil so that important physical properties, such as pore space, are not degraded. Soil compaction is any weight on the soil that pushes the soil particles together. When compaction occurs in the surface layer or the subsoil, aeration is impaired and plant roots have more difficulty pushing through the soil to a source of water. Other soil conditions that affect compaction are wetness and clayey textures in the surface layer and the subsoil.

Figure 12.—Crop residue on the surface of Promise clay, 0 to 3 percent slopes.

Managers can have a positive influence on tilth and compaction by including high-residue crops in the crop rotation most of the time, keeping equipment or livestock off the soil during wet periods, leaving as much residue as possible at or near the surface of the soil, and eliminating unnecessary tillage operations. The timing of farming operations is critical. If compaction has occurred, it can be reduced through ripping or deep plowing. Tilth and compaction are especially important on clayey soils, such as Bullcreek, Opal, and Promise soils, and on soils that have a claypan and are affected by sodium, such as Capa and Mosher soils.

Sodium-affected soils provide some additional management problems. In addition to tilth and compaction concerns, they have slow water intake, are less productive because of the lower organic matter content, and restrict root and moisture penetration because of the dense, compact subsoil. Management of sodium-affected soils should always involve tilling in a timely manner, minimizing tillage, leaving crop residue on the surface in order to maintain organic matter content levels, and maintaining tilth. Rotations that include grasses and legumes help to maintain organic matter content, fertility, and tilth. Chiseling and subsoiling when the soil is dry help to increase the water infiltration rate.

Field crops that are suited to the soils and climate of the county include small grain and row crops. Winter wheat, spring wheat, and oats are the main small grain crops. Grain sorghum is the main row crop.

All of the crops commonly grown in the county are suited to Kirley, Nimbro, Promise, and Ree soils and other very deep and deep, well drained soils. Moderately deep soils that have a low available water capacity, such as Lakoma and Opal soils, are better suited to early maturing small grain crops than to the deeper rooted crops, such as sorghum and alfalfa. Soils that are susceptible to erosion, such as Bigbend and Inavale soils, also are better suited to small grain and alfalfa, which provide better protection against wind erosion than row crops.

Pasture and Hayland

David W. Schmidt, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Pasture and hayland are used for the production of adapted domesticated perennial forage plants to be grazed by livestock or harvested for hay. These forage plants can be either native or introduced species and can be seeded alone or in a mixture. Generally, these species are established as part of a long-term forage program, but in some areas legumes or grasses have been established as part of a short-term crop rotation.

About 7 percent of the county is classified as pasture and hayland *(13)*. This acreage supplies a major part of the forage for livestock. It includes areas that formerly supported native vegetation but have been invaded by introduced tame grasses, such as smooth bromegrass, because of overgrazing in the past. Managing these areas as native rangeland is no longer practical in many cases. Because of overgrazing, improper management, and poor agronomic practices, much of the pasture and hayland is presently producing well below its potential.

Proper management of pasture and hayland is needed to obtain maximum sustained yields. Proper stocking rates allow the pasture plants to retain their vigor. Overgrazing results in depletion of the root systems of the pasture plants. If continued overgrazing is allowed, the plants eventually die and are replaced by less desirable species and weeds. A planned grazing system that includes periods of adequate rest or deferment for the key pasture species improves plant vigor and thus improves production. Including rest periods between grazing allows the pasture plants to regrow and replenish energy reserves. Harvesting hay crops at the proper stage of plant growth also helps to maintain plant vigor. Generally, the plants should be harvested at early to mid bloom stage. Grazing pasture species at the proper stage of growth also increases plant vigor and production. The plants should not be grazed before they have produced enough leaf material to replenish stored energy reserves. Generally, the plants should be allowed to grow to a height of 8 to 14 inches before they are grazed. The proper height depends on the species being managed. If the plants become too tall or mature before grazing is allowed, the quality and, to some extent, quantity of the forage can be affected. Also, allowing the plants to regrow before the first killing frost provides adequate energy reserves for survival through the winter and for the initiation of growth in the spring, thus improving production the following year. Allowing regrowth also increases the ability of the plants to trap snow, thereby increasing soil moisture.

Pasture and hayland species can be divided into two broad categories. Cool-season species begin their growth in early spring and reach maturity in early summer. If soil moisture is adequate, they may regrow in the fall when temperatures cool. Warm-season species begin growth in early summer. They produce most of their forage during the hot summer months. Cool-season plants include smooth bromegrass, intermediate wheatgrass, and alfalfa. Warm-season species include big bluestem and switchgrass. Selecting a warm-season species, such as big bluestem, ensures a productive, nutritious forage source for livestock during July and August. Using a cool-season species, such as smooth bromegrass, during this period would produce less forage.

Proper management includes periodic reestablishment of pasture and hayland. The length of time that pasture and hayland remain productive depends on the plant species, the type of soil, climatic factors, and management techniques. Generally, many of the tame species should be replaced every 5 to 10 years. Native species that are adapted to the site generally remain productive for an extended period of time, depending on the kind of management applied. Species selection should be based on the type of soil and on producer needs. Using improved varieties can result in increased production, improved forage quality, and improved establishment and longevity of the stand.

Maintaining soil fertility is an important management concern. Applications of fertilizer should be based on the results of soil tests. Care should be taken to prevent the contamination of water supplies and to assure economic feasibility. Proper levels of fertilization can increase production, increase the longevity of the stand, and improve the quality of the forage. Planting legumes, such as alfalfa, in combination with grasses can often increase the nitrogen level and thus help to meet the nutrient needs of grass species.

Weeds can be a problem if proper management techniques are not applied. Allowing overgrazing, failing to maintain soil fertility, and selecting species that are not adapted to the site can increase the extent of weeds in areas of pasture and hayland. Weeds that appear should be controlled within economical constraints.

At the end of each map unit description and in the section "Interpretive Groups," each soil has been assigned to a pasture suitability group. These groups are based primarily on the suitability of the soil for

certain pasture or hayland species, management needs, and potential productivity. The principal criteria for assigning a soil to a pasture suitability group include depth, drainage class, texture, structure, permeability, available water capacity, landscape position, and special internal features. The descriptions include hazards and limitations affecting the use of the soils for pasture and hayland and the species that are best suited to the group. The species are selected based on yield potential, adaptability to the site, palatability, and relative ease of establishment. These descriptions can be used when making decisions on land use conversions and selection of species. More detailed information is available in the local office of the Natural Resources Conservation Service.

Group B1. The soils in this group receive additional moisture from runoff or flooding. Because of the excess moisture, the selection of climatically adapted grasses is limited to water-tolerant species.

The soils in this group generally are not artificially drained and do not have a water table that is seasonally high for long periods. A typical soil is Herdcamp soil. The species that are most suitable in areas of these soils include creeping foxtail, western wheatgrass, and reed canarygrass. The main management concern is surface compaction, which can result from haying or grazing during periods when the soil is saturated. Deferred grazing or haying during these periods can minimize compaction and improve plant vigor.

Group B2. The soils in this group receive additional moisture from runoff. Because of the excess moisture, the selection of climatically adapted grasses is limited to water-tolerant species.

The soils in this group generally are not artificially drained. Typical soils are Albaton, Hoven, and Kolls soils. The species that are most suitable in areas of these soils include western wheatgrass. The major management concern is surface compaction during periods when the soil is saturated. Deferred grazing and haying during these periods can minimize compaction and improve plant vigor.

Group C. The soils in this group have a claypan subsoil that has slow or very slow permeability. Typically, a high content of soluble salts are in the underlying material and the lower part of the subsoil. The restricted root zone limits the selection and productivity of climatically adapted grasses and legumes.

The soils in this group consist mainly of very deep, deep, and moderately deep soils that are well drained to somewhat poorly drained. They have a silty or loamy surface layer about 5 to 10 inches thick. A typical soil is Mosher soil. The species that are most suitable in areas of these soils include alfalfa, crested wheatgrass, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass. The major management concerns are the accumulation of excess salts, surface compaction, and the inherent droughtiness. Proper grazing use, deferred grazing, and proper hayland management are needed to maintain a healthy plant community and minimize management concerns.

Group D2. The soils in this group have a shallow root zone and a low available water capacity, which limit the selection of climatically adapted grasses.

The soils in this group consist of excessively drained to moderately well drained soils that are shallow over sand and gravel. A typical soil is Vivian soil. The species that are most suitable in areas of these soils include crested wheatgrass and pubescent wheatgrass. Maintaining the plant community is the major management concern on these soils because of the extreme droughtiness resulting from the low available water capacity and the shallow root zone. Proper grazing use, deferred grazing, a planned grazing system, and timely harvesting help to maintain plant vigor.

Group E. The soils in this group have slow or moderately slow permeability. They have a medium or moderately fine textured surface layer. The underlying material is fine or moderately fine textured material underlain by medium textured material. The unfavorable root zone limits the selection and productivity of climatically adapted grasses and legumes.

A typical soil is Hilmoe silt loam. The species that are most suitable in areas of these soils include alfalfa, crested wheatgrass, green needlegrass, intermediate wheatgrass, and pubescent wheatgrass. The major management concerns are maintaining plant vigor and maintaining soil tilth. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth. Applications of fertilizer may also be needed.

Group F. The soils in this group are medium or moderately fine textured and have moderate or moderately slow permeability. Some of these soils are rarely flooded and calcareous or have a water table that is seasonally high for short periods. The soils in this group are suited to all climatically adapted grasses and legumes, but bunch-type grass species are not recommended in areas where the slope is 6 percent or more.

Typical soils are Bigbend, Kirley, Nimbro, and Ree soils. The species that are most suitable in areas of

these soils include alfalfa, big bluestem, green needlegrass, indiangrass, intermediate wheatgrass, smooth bromegrass, switchgrass, and orchardgrass. The major management concerns are maintaining plant vigor and maintaining soil tilth. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth. Applications of fertilizer may also be needed.

Group H. The soils in this group have moderately rapid or rapid permeability. Some of these soils are rarely flooded. These soils have a low or moderate available water capacity. The hazard of erosion and a limited available water capacity limit the selection and productivity of climatically adapted grasses and legumes.

A typical soil is Inavale soil. The species that are most suitable in areas of these soils include alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, big bluestem, sand bluestem, indiangrass, and switchgrass. The major management concerns are maintaining plant vigor and controlling erosion. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and provide a sufficient plant cover to control erosion.

Group I. The soils in this group have an unfavorable root zone and a very slow rate of water infiltration, which limit the selection and productivity of climatically adapted grasses and legumes.

Typical soils are Hilmoe silty clay and Lakoma, Millboro, Opal, Promise, Wendte, and Witten soils. The species that are most suitable in areas of these soils include alfalfa, crested wheatgrass, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass. The major management concerns are maintaining plant vigor and maintaining soil tilth. During wet periods, compaction is also a concern on these soils. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth.

Group NS. The soils in this group are not suitable for pasture plantings because they are steep, are very shallow to gravel, are sandy and have a low content of organic matter, are very strongly saline or alkaline, are clayey and have a dense subsoil, are stony or very stony, or are subject to ponding.

This group consists mainly of shallow to very deep soils. Typical soils are Bullcreek, Capa, Okaton, Sansarc, and Vivian soils. Also included are the Lakoma and Opal soils that are steeply sloping and the channeled Nimbro and Wendte soils.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit is shown in the section "Interpretive Groups," which follows the tables at the back of the survey.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include a cropping sequence that allows the efficient use of available moisture, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and other essential elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service, the South Dakota Cooperative Extension Service, or the South Dakota Agricultural Experiment Station can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would

change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for pasture and hayland, for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit *(8)*. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations or hazards, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-1. The capability units are not numbered consecutively because not all of the units in the land capability system are represented in the county.

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables at the back of the survey.

Rangeland

Wayne L. Vander Vorste, resource conservationist, Natural Resources Conservation Service, helped prepare this section.

Rangeland is land on which the natural potential plant community consists of grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. Included are areas that have been naturally or artificially revegetated and are managed like rangeland. The amount and kind of native vegetation grown in any one area are determined by the soil, topography, climate, past use, and management.

Nearly all of the county was rangeland before the first permanent settlers arrived. The exceptions were the narrow areas of woodland along rivers, drainageways, and steep breaks and the barren areas of shale rock outcrop. About 57 percent of the county currently supports native vegetation *(11)*. Rangeland supplies a major part of the forage and feed for livestock in the county.

About 80 percent of the farm and ranch income in the county is derived from the sale of livestock and livestock products *(13)*. Most of the ranches are cow-calf enterprises, but a few are strictly yearling enterprises. Some ranches are combined cow-calf and yearling enterprises. This practice provides greater flexibility in adjusting forage demand to a widely fluctuating, rainfall-dependent forage supply. A limited number of sheep are throughout the county, and they are often run along with cattle. The rangeland generally is grazed from May to December; however, some ranchers graze beef cattle and horses year-round. The forage provided by rangeland generally is supplemented by crop residue and tame pasture plants, such as intermediate wheatgrass and crested wheatgrass. In winter, it is supplemented by protein concentrate and hay.

Jones County is in the mixed-grass prairie region. The native vegetation is dominated by mid grasses,

such as western wheatgrass, and forbs, such as fringed sagewort. Short grasses, such as blue grama and buffalograss, are interspersed with the mid grasses. In some areas, such tall grasses as big bluestem, switchgrass, and prairie cordgrass are dominant. The mixed-grass prairie consists of cool- and warm-season plants that provide good-quality forage throughout the growing season. The cool-season plants, such as green needlegrass and pasqueflower, grow and mature from April through June. The warm-season plants, such as little bluestem and dotted gayfeather, grow and mature from June through August.

The production of native vegetation in some parts of the county is below potential because of past overgrazing and physical damage by livestock. The taller, most palatable grasses, forbs, and shrubs have been replaced by plants that are less desirable for livestock grazing. In many areas, the warm-season tall and mid grasses have been replaced by cool-season annual and perennial grasses, such as Japanese brome and western wheatgrass. The result is a predominantly cool-season plant community that matures early in the grazing season, thereby losing palatability and negatively impacting livestock performance from midsummer on. Woody plants that typically grow along creek channels and on the steep slopes have been reduced or eliminated by livestock browsing, trampling, and rubbing. In most areas, however, enough of the desirable plants remain to reestablish the high-quality natural potential plant community.

Range Sites and Condition Classes

A range site is an area of rangeland that has the potential to produce and sustain a distinctive native plant community. The characteristic plant community of a range site differs from others in the kind and amount of native plants that the range site is capable of supporting. The potential native plant community on each range site is the result of a unique combination of environmental factors, particularly climate and soils.

Within climatic zones, differences in the soils account for the variations in the potential plant community on a range site; therefore, soils are synonymous with range sites. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the plant community. Soil reaction, texture, salt content, and rooting depth are also important. Soils that produce approximately the same kinds, amounts, and proportions of native vegetation make up a range site. The potential plant community on a range site is the most stable plant community that the site is capable of producing. It maintains itself and changes very little as long as the environment remains unchanged. The relationship between soils and vegetation was ascertained during the survey; thus, range sites generally can be determined directly from the soil map.

The plants within the native plant community are sometimes grouped as decreasers, increasers, and invaders, depending on their response to grazing pressure. *Decreasers* are plants that respond to overgrazing by decreasing in abundance. They generally are the taller, more productive plants and are most preferred by the grazing animals. *Increasers* are plants that respond to grazing pressure by increasing, at least initially, in amount as the more preferred decreaser plants become less abundant. Increasers are generally less productive and less nutritious than decreasers. *Invaders* are plants that are not part of the original plant community but invade the range site because of continued overgrazing or some other kind of disturbance to the ecosystem. Most invader plants have little or no value for grazing; however, tame grasses, such as smooth bromegrass and crested wheatgrass, have value for grazing.

Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others. For example, a cool-season plant may be a decreaser if the site is grazed only during the spring, but it would be an increaser if the same site were grazed only during the summer. The reverse would be true for warm-season plants. Restricting grazing to the spring would result in warm-season plants increasing in abundance, and they would decrease if grazing were restricted to the summer.

Table 7 shows, for each soil, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. *Potential annual production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperature make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Clipping data has shown that annual production during unfavorable years can be as much as 25 percent below average.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Good range management helps to maintain the capacity of the rangeland to produce optimum amounts of forage for livestock, food and cover for wildlife, good-quality water, and watershed protection. The primary objective of good range management is to keep the rangeland in excellent or good condition because rangelands are best able to satisfy the need for these products when they are in these conditions. Recognizing and responding to important changes in the plant community that are contrary to rangeland health and management objectives is the main management concern for range managers. Monitoring the range condition and trend is important in good range management because it can help managers evaluate the effects of management inputs on the range resource and enable them to make needed adjustments.

Range condition is determined by comparing the present vegetation on a range site with the potential natural plant community for that site. Four range condition classes are recognized. The range site is in *excellent* condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation; in *good* condition if the percentage is 51 to 75 percent; in *fair* condition if the percentage is 26 to 50 percent; and in *poor* condition if the percentage is 25 percent or less. The potential annual production depends on the range site, the range condition, and the moisture available to plants during the growing season.

Measures that maintain or improve the range condition are needed on all of the rangeland in the county. They include proper stocking rates and rotation grazing or deferred rotation grazing systems. These systems provide rest periods that maintain or improve the vigor of the key plants and protect or minimize soil compaction. Good range management also includes range seeding, fencing, and watering facilities for livestock.

Fifteen range sites are recognized in the county. The range sites are Clayey, Clayey Overflow, Claypan, Closed Depression, Dense Clay, Loamy Overflow, Loamy Terrace, Sands, Shallow, Shallow Clay, Shallow Marsh, Silty, Thin Claypan, Thin Upland, and Wetland. The paragraphs that follow describe these range sites.

Clayey range site. The potential native vegetation is mid and short prairie grasses interspersed with a variety of forbs. Cool-season grasses and sedges make up about 75 percent of the vegetation. They include 45 percent western wheatgrass, 25 percent green needlegrass, and 5 percent sedges. Sideoats grama, blue grama, and buffalograss, which are warm-season grasses, make up about 20 percent of the vegetation. Forbs, such as western yarrow, fringed sagewort, cudweed sagewort, sweetclover, and scarlet globemallow, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If continuous overgrazing is allowed, green needlegrass and sideoats grama rapidly lose their productive capacity because of their palatability to livestock. If overgrazing is allowed, western wheatgrass initially increases in abundance, but if overgrazing continues, it decreases in abundance. Blue grama, buffalograss, and sedges increase in abundance as the taller grasses decrease in abundance. A less productive short grass plant community and an increased runoff rate result. The extent of the most productive grasses can be maintained by using proper stocking rates and by using a rotation grazing or a deferred grazing program, which provides periodic rest periods during the growing seasons of these plants. Limiting grazing on these sites during wet periods limits soil compaction.

Clayey Overflow range site. The potential native vegetation on this site is mid prairie grasses. Cool-season grasses, such as western wheatgrass and green needlegrass, make up about 75 percent of the plant community. Warm-season, short grasses, such as blue grama and buffalograss, make up about 10 percent. Forbs, shrubs, and trees make up the rest. In some areas fed by springs or seeps, prairie cordgrass is the dominant species in the plant community. Taller shrubs and trees, such as plum, chokecherry, buffaloberry, green ash, and cottonwood, commonly occur on this range site and can be dominant.

The major management concerns on this site are maintaining the extent of the most productive grasses and an adequate plant cover to help control gully erosion. If continued overgrazing is allowed, green needlegrass rapidly decreases in abundance because of its palatability to livestock. Western wheatgrass initially increases in abundance as green needlegrass decreases in abundance. If overgrazing continues, the warm-season, short grasses, such as blue grama and buffalograss, become the dominant grasses on the site. The result is lower forage production. If extreme overgrazing is allowed, the areas of bare surface increase and the site is susceptible to gully erosion. The extent of the most productive grasses can be increased or maintained by using proper stocking rates and a deferred grazing program during the critical growth stages of the cool-season grasses.

Limiting grazing on these sites during wet periods limits soil compaction.

Claypan range site. The potential native vegetation is a prairie of mid and short grasses interspersed with some forbs. Cool-season grasses make up about 65 percent of the vegetation. They include 40 percent western wheatgrass, 20 percent green needlegrass, and 5 percent needleandthread. Blue grama, the dominant warm-season grass, and buffalograss make up about 20 percent of the vegetation. Sedges, which are grasslike plants, and forbs make up about 10 percent of the vegetation. Shrubs, such as silver sagebrush and pricklypear, make up about 5 percent of the vegetation.

The major management concern on this site is maintaining the most productive grasses. If continued overgrazing is allowed, green needlegrass and western wheatgrass rapidly decrease in abundance because of their palatability to livestock. Blue grama, buffalograss, sedges, and pricklypear increase in abundance as the other grasses decrease in abundance. The result is low forage production for livestock. The extent of the most productive grasses can be maintained by using proper stocking rates and by using a rotation grazing or a deferred grazing program, which provides periodic rest periods during the key growing seasons of these plants. Limiting grazing on these sites during wet periods limits soil compaction.

Closed Depression range site. The potential vegetation is dominated by about 85 percent western wheatgrass, about 10 percent sedges, and about 5 percent forbs. The plant community is not stable, however, because of the wet and dry cycles of the site. This site occurs on flat or concave bottoms of closed depressions. Thus, the site is excessively wet or ponded in early spring and during wet periods and dry during other seasons and abnormally dry periods.

The major management concern on this site is maintaining the most desirable plant community. If continued overgrazing is allowed, the extent of western wheatgrass is reduced and the trampling of livestock aggravates the poor drainage on the site. If the site is overgrazed, saltgrass and curled dock increase in abundance and foxtail barley invades as western wheatgrass decreases in abundance. The result is low production. The extent of the most productive grasses can be maintained by using proper stocking rates and by using deferred grazing, particularly when the surface is saturated and the plants are subject to damage from trampling. Soil compaction is a potential problem during wet periods. Deferred grazing reduces this problem and improves plant vigor.

Dense Clay range site. The potential native vegetation on this site is mid prairie grasses that are interspersed with forbs. Cool-season grasses on this site include western wheatgrass and green needlegrass. Western wheatgrass makes up 70 percent of the vegetation, and green needlegrass makes up 20 percent. Forbs, such as wild onion and wild parsley, and shrubs, such as pricklypear and silver sagebrush, make up about 10 percent of the vegetation. This site is on landscape positions slightly below those of the Clayey range site and can be differentiated by the absence of an understory of short grasses.

The major management concern on this site is maintaining the extent of green needlegrass and western wheatgrass. If continued overgrazing is allowed, these grasses decrease in abundance and are replaced by increasers, such as pricklypear, and invaders. If extreme overgrazing is allowed, the surface becomes bare and highly susceptible to erosion. The extent of green needlegrass and western wheatgrass can be maintained by using proper stocking rates and by using deferred grazing or a rotation grazing program, which provides periodic rest periods during the growing seasons of these grasses late in spring and early in summer.

Loamy Overflow range site. The potential native vegetation is a mixture of tall and mid grasses. Big bluestem, which is a tall, warm-season grass, makes up about 40 percent of the vegetation. Other warm-season, tall and mid grasses, such as switchgrass, indiangrass, and little bluestem, make up 20 percent of the vegetation. Cool-season grasses, such as green needlegrass, western wheatgrass, and Kentucky bluegrass, make up 25 percent. Forbs, such as western yarrow and American licorice, and shrubs, such as leadplant, western snowberry, and wild rose, make up about 15 percent of the vegetation. Taller shrubs and trees, such as chokecherry, buffaloberry, bur oak, green ash, cottonwood, and hackberry, commonly occur on this range site and can dominate the plant community.

The major management concern on this site is maintaining the most productive grasses. If continued overgrazing is allowed, big bluestem, switchgrass, green needlegrass, indiangrass, and little bluestem rapidly lose their productive capacity and thin out because of their palatability to livestock. Western wheatgrass initially increases in abundance as these grasses decrease in abundance. If overgrazing continues, Kentucky bluegrass, a cool-season, short grass, increases and becomes the dominant plant. The result is low forage production. The extent of the most productive grasses can be increased or

maintained by using proper stocking rates and by using a deferred grazing or rotation grazing program, which provides periodic rest periods during the key growing season of the desirable plants.

Loamy Terrace range site. The potential native vegetation on this site is a mixture of mid and tall grasses. Cool-season grasses make up about 70 percent of the vegetation. They include 30 percent western wheatgrass, 30 percent green needlegrass, and 10 percent needleandthread. Warm-season grasses make up about 20 percent of the vegetation. They include 10 percent bluestems, 5 percent prairie sandreed, and 5 percent blue grama. Forbs, such as fringed sagewort, and shrubs, such as western snowberry, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If continued overgrazing is allowed, western wheatgrass, green needlegrass, needleandthread, and prairie sandreed decrease in abundance while buffalograss, blue grama, forbs, and woody plants increase in abundance. The extent of the most productive grasses can be maintained by using proper stocking rates and by using a deferred grazing program or rotation grazing.

Sands range site. The potential native vegetation is mixed tall and mid prairie grasses. Warm-season grasses, such as prairie sandreed, little bluestem, big bluestem, and sand bluestem, make up about 70 percent of the vegetation. Switchgrass, indiangrass, needleandthread, and blue grama occur in lesser extent and make up about 20 percent of the vegetation. Forbs and shrubs, such as leadplant, wild rose, and sand cherry, make up the rest.

The major management concern on this site is maintaining the extent of the most productive tall grasses. If continued overgrazing is allowed, little bluestem, big bluestem, prairie sandreed, and switchgrass are replaced by sand dropseed and blue grama. If overgrazing continues, green sagewort and sandbur increase in abundance, or the surface becomes bare. The bare surface areas are highly susceptible to the hazard of wind erosion. The most productive grasses can be increased or maintained by using proper stocking rates and by using a deferred grazing program or rotation grazing.

Shallow range site. The potential native vegetation is a mixed-grass prairie. Warm-season grasses that dominate the vegetation include 40 percent little bluestem and 30 percent sideoats grama, big bluestem, blue grama, and plains muhly. Cool-season grasses, such as green needlegrass, western wheatgrass, needleandthread, and sedges, make up about 20 percent of the vegetation. Forbs, such as bracted spiderwort, black samson, and sageworts, and woody plants, such as leadplant, yucca, skunkbush sumac, buffaloberry, and wild rose, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If continued overgrazing is allowed, little bluestem, big bluestem, green needlegrass, and plains muhly decrease in abundance because of their palatability to livestock. Western wheatgrass, sideoats grama, and needleandthread initially increase in abundance after overgrazing, but if overgrazing continues, they decrease in abundance and are replaced by short grasses, such as blue grama. The result is low forage production. The extent of the most productive grasses can be improved or maintained by using proper stocking rates and by using a deferred grazing program or rotation grazing, which provides periodic rest periods during the key growing season of the desirable plants.

Shallow Clay range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses make up about 50 percent of the vegetation. They include 30 percent little bluestem, 5 percent big bluestem, 10 percent sideoats grama, and 5 percent blue grama. Cool-season grasses, such as western wheatgrass and green needlegrass, make up about 35 percent of the vegetation. Sedges, shrubs, and forbs make up the rest.

In some areas where the bedded shale is within 10 to 12 inches of the surface and little soil development has occurred, the plant community is similar to that on the Sands range site. Big bluestem and little bluestem are the dominant plants in these areas. Sideoats grama and prairie sandreed are also abundant. Except for a sparse stand of sedges, no cool-season grasses are in these bedded shale areas.

The major management concern on this range site is maintaining the extent of the most productive grasses. If the site is overgrazed, little bluestem, big bluestem, and green needlegrass rapidly decrease in abundance, and western wheatgrass and sideoats grama initially increase in abundance. If overgrazing continues, these grasses decrease in abundance and sedges increase in abundance, or the surface becomes bare. Low forage production and an increased runoff rate and an increased hazard of erosion result. If the site is overgrazed, shale blowouts can also form. The extent of the most productive grasses can be maintained by moderate stocking rates and by deferred grazing during the growing season of the most productive plants. Limiting grazing on these sites during wet periods limits soil compaction.

Shallow Marsh range site. This site is ponded in

spring and early summer. The potential native vegetation is a prairie of water-tolerant grasses, sedges, forbs, and spikerushes. Smartweed and common spikesedge are the dominant plants and make up about 70 percent of the vegetation. Curled dock, western wheatgrass, and prairie cordgrass make up about 20 percent of the vegetation. Foxtail barley, bur-reed, American bulrush, and prickly lettuce make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If continued overgrazing is allowed, western wheatgrass decreases in abundance and is replaced by foxtail barley and prickly lettuce. An increase in the abundance of the less palatable vegetation results in a loss of grazeable forage. The most productive grasses can be maintained by using proper stocking rates and by using a grazing program, which involve timely deferments to provide rest periods during the key growing season of these plants. Deferred grazing reduces the potential for soil compaction during wet periods and improves plant vigor.

Silty range site. The potential native vegetation is a mixed-grass prairie. Cool-season grasses make up about 70 percent of the vegetation. Green needlegrass and western wheatgrass are the major cool-season grasses. Needleandthread and porcupinegrass occur in lesser extent. Warm-season grasses, such as big bluestem, sideoats grama, and blue grama, make up about 20 percent of the vegetation. Forbs, such as sageworts and false boneset, and shrubs, such as leadplant, wild rose, and western snowberry, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If continued overgrazing is allowed, the extent of big bluestem, porcupinegrass, and green needlegrass decrease in abundance because of their palatability to livestock. If overgrazing is allowed, western wheatgrass and needleandthread initially increase in abundance. If overgrazing continues, blue grama becomes the dominant grass and a wide variety of low value forbs, such as curlycup gumweed and sagewort, increase in abundance. The result is low forage production. The extent of the most productive grasses can be increased or maintained by using proper stocking rates and by using a deferred grazing program or rotation grazing, which provides periodic rest periods during the key growing season of the desirable plants.

Thin Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Cool-season grasses make up about 40 percent of the vegetation. They include 25 percent western wheatgrass and 15 percent needleandthread. Warm-season, short grasses, such as blue grama and buffalograss, make up about 40 percent of the vegetation. Inland saltgrass and sedges make up about 10 percent, and forbs, such as sagewort, heath aster, and broom snakeweed, make up the rest.

The major management concern on this site is maintaining western wheatgrass. If continued overgrazing is allowed, the extent of western wheatgrass decreases in abundance and blue grama, buffalograss, pricklypear, and saltgrass increase in abundance. If overgrazing continues, large areas of the surface become bare, especially during dry periods, and weeds are abundant during wet periods. Western wheatgrass can be improved or maintained by using proper stocking rates and by using a deferred grazing program, which provides periodic rest periods during the key growing season. Restricted grazing during wet periods helps to prevent surface compaction, puddling, and physical damage to the vegetation.

Thin Upland range site. The potential native vegetation is a mixed stand of mid and tall grasses. Warm-season grasses make up about 60 percent of the vegetation on this site. The dominant warm-season grass is little bluestem, which makes up 20 percent of the vegetation. Other warm-season grasses on the site include big bluestem, sideoats grama, blue grama, and prairie sandreed, which make up 40 percent of the vegetation. Cool-season grasses, such as porcupinegrass, green needlegrass, needleandthread, and western wheatgrass, make up about 20 percent of the vegetation. Needleleaf sedge and threadleaf sedge make up about 10 percent of the vegetation. Forbs, such as black samson, groundplum milkvetch, and sageworts, and shrubs, such as wild rose, leadplant, dwarf indigo, skunkbush sumac, buffaloberry, and yucca, make up the rest.

The major management concern is maintaining the most productive grasses and the desirable balance of cool- and warm-season grasses. If continued overgrazing is allowed, little bluestem, big bluestem, and green needlegrass decrease in abundance and western wheatgrass, sideoats grama, and sedges increase in abundance. If overgrazing continues, sedges, blue grama, and unpalatable forbs increase in abundance. The extent of the most productive grasses can be maintained by using proper stocking rates and by using rotation grazing or a deferred grazing program, which provides periodic rest periods during the key growing season of these plants.

Wetland range site. The potential native vegetation is a prairie of water-tolerant, tall grasses, sedges, cattails, and rushes. Prairie cordgrass is the dominant

species. It makes up about 70 percent of the vegetation. Other grasses include switchgrass and Canada wildrye, which make up about 10 percent. Wetland sedges, cattails, and rushes make up about 10 percent. Forbs, such as smartweed and pale dock, and shrubs, such as indigobush amorpha and willows, make up about 10 percent.

The major management concern on this site is maintaining the most productive grasses and keeping an adequate amount of plant cover on sites along drainageways, which are very susceptible to gully erosion. Prairie cordgrass is strongly rhizomatous and becomes coarse and stemmy as it matures, which makes it resistant to overgrazing. If continued grazing is allowed early in the growing season when prairie cordgrass is more palatable, it decreases in abundance. Smartweed, saltgrass, and rushes increase in abundance with overgrazing. If continued overgrazing is allowed, bare areas of the surface increase greatly, resulting in a severe hazard of gully erosion and long-term damage to the site. The most productive grasses can be maintained or increased on this site by using proper stocking rates and by using a deferred grazing program during the critical early stages of growth of the warm-season grasses. Restricting grazing during wet periods helps to limit soil compaction.

Native Woodland, Windbreaks, and Environmental Plantings

Thomas A. Hurford, resource conservationist, Natural Resources Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 12,000 acres in Jones County (fig. 13). Most wooded areas occur on low flood plains along the Bad and White Rivers and along small creeks and drainageways. The soils that support trees and shrubs are not classified as woodland soils. Nearly all of the wooded areas provide habitat for wildlife and protection for livestock.

Nimbro, channeled; Bigbend, flooded; Bigbend; and Inavale soils adjacent to the Bad and White Rivers and Wendte, channeled and Nimbro soils along the larger drainageways are associated with native trees and shrubs. Also, native trees and shrubs occur on some of the soils along the minor drainageways, such as Okaton, Wendte, and Nimbro soils. Common species include plains cottonwood, American elm, green ash, peachleaf willow, sandbar willow, common chokecherry, American plum, false indigo, wild rose, boxelder, western snowberry, and skunkbush sumac.

Windbreaks have been planted since the days of the early settlers to protect farmsteads and livestock from wind and snow and to protect and furnish habitat for wildlife. They are still needed throughout the county. These are generally multirow plantings around buildings and livestock operations. A mixture of broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. These plantings help to control wind erosion and generally consist of one or two rows of trees. Also, planting trees in areas adjacent to drainageways helps to improve water quality.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. To ensure plant survival and rates of growth, adapted species should be properly planted on a well prepared site and maintained in good condition. Weed control is needed for a minimum of 3 to 5 years to ensure long-term survival.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and other plantings.

Establishing windbreaks is difficult in Jones County because of low rainfall. Fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before seedlings can be established. Cultivation and applications of herbicide are effective in controlling weeds.

Grazing is extremely damaging to windbreaks and environmental plantings because the livestock compact the soil and remove the lower branches of the trees and shrubs. Removal of the lower branches reduces the effectiveness of the windbreaks.

At the end of each description under the heading "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables in the back of the survey, the soils are assigned to windbreak suitability groups. A windbreak suitability group is a distinctive group of soils that supports trees and shrubs having similar growth and survival rates if weather conditions are normal and the windbreak is properly managed. The relationship between the soils and the growth of trees and shrubs was ascertained during this survey. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the growth of trees and shrubs. Soil reaction, salt content, and a seasonal high water table also are important. Detailed interpretations for each windbreak

Figure 13.—Native plains cottonwood in an area of Bigbend silt loam along the White River.

suitability group in the county are provided in the "Technical Guide," which is available in the local office of the Natural Resources Conservation Service.

Group 1. These soils are well suited to woody plantings. They are on high and low flood plains. These soils receive additional moisture from runoff and flooding. Some areas are subirrigated. All climatically suited trees and shrubs grow well.

This group consists mainly of very deep, somewhat poorly drained to well drained, loamy, silty, and clayey soils. Available water capacity is moderate or high. The fine sandy loams and loamy fine sands are subject to a severe hazard of wind erosion. Typical soils in this group are Bigbend and Nimbro soils.

Group 2. These soils are well suited to woody plantings. They receive additional moisture from runoff or have a high water table within the root zone. All climatically suited trees and shrubs grow well.

None of the soils in Jones County are assigned to this group.

Group 3. These soils are well suited to woody plantings. They are on summits, shoulder slopes, back slopes, and foot slopes on terraces. Except for those trees and shrubs that require abundant moisture, all climatically suited trees and shrubs grow well.

This group consists of very deep, well drained, loamy and silty soils. Available water capacity is moderate or high. The susceptibility to water erosion ranges from slight in the nearly level areas to severe in the strongly sloping areas. The susceptibility to wind erosion ranges from slight to severe. Typical soils in this group are Kirley and Ree soils.

Group 4. These soils are fairly well suited to woody plantings. They are on summits, shoulder slopes, back slopes, and foot slopes on plains and dissected plains and on high flood plains. Most of the climatically suited

trees and shrubs grow well; however, maximum growth is not possible because of limited root development.

This group consists of moderately deep, deep, and very deep, clayey soils and clayey soils that have a surface layer of loamy and silty material. The soils are moderately well drained and well drained. Available water capacity is low or moderate in the more clayey soils and moderate or high in the silty and loamy soils. Soils that have accumulations of salts in the lower part of the subsoil also are in this group. The clayey soils are subject to a severe hazard of wind erosion. The moderately sloping and strongly sloping soils are subject to a severe hazard of water erosion. Typical soils in this group are Hilmoe, Millboro, Opal, Promise, Wendte, and Witten soils.

Group 5. These soils are well suited to woody plantings. They are on high flood plains. All climatically suited trees and shrubs grow well, except those that require abundant moisture.

This group consists mainly of very deep, well drained and somewhat excessively drained, loamy and sandy soils. Available water capacity generally is low or moderate. These soils are subject to a severe or very severe hazard of wind erosion. Inavale soils are typical of this group.

Group 6. These soils are poorly suited to woody plantings. No trees and shrubs grow well on the soils in this group. Plantings can be established, but optimum survival and growth should not be expected. Field windbreaks are not effective because of the slow growth rate and the low height at maturity.

This group consists of well drained and somewhat excessively drained, silty and loamy soils that are moderately deep to bedrock or are shallow or moderately deep to sand and gravel. Available water capacity is low or moderate. The moderately sloping and strongly sloping soils are subject to a severe hazard of erosion. None of the soils in Jones County are assigned to this group.

Group 7. These soils are poorly suited to woody plantings. No trees or shrubs grow well on soils in this group. Coniferous trees and shrubs are better suited to these soils than deciduous trees and shrubs. Plantings can be established, but optimum survival and growth should not be expected. Field windbreaks are not effective because of the slow growth rate and the low height at maturity.

This group consists of very deep, deep, and moderately deep, somewhat excessively drained and excessively drained, sandy soils. Available water capacity is very low or low. These soils are subject to a very severe hazard of wind erosion. None of the soils in Jones County are assigned to this group.

Group 8. These soils are poorly suited to woody plantings. They are on summits, shoulder slopes, and back slopes on dissected plains and terraces. No trees and shrubs grow well on soils in this group. Plantings can be established, but optimum survival and growth should not be expected. Field windbreaks are not effective because of the slow growth rate and the low height at maturity.

This group consists of very deep, deep, and moderately deep, well drained, loamy and silty soils that contain enough calcium carbonate at or near the surface to adversely affect the growth and survival of trees and shrubs. Available water capacity is moderate or high. These soils are subject to a severe hazard of wind erosion and water erosion. Typical soils in this group are Lakoma and Vivian soils.

Group 9. These soils are poorly suited to woody plantings. They have a dense claypan subsoil and an excessive amount of salt in the lower part of the subsoil. They are on foot slopes on terraces. No trees and shrubs grow well on these soils because of the adverse effect of the dense claypan subsoil and the salts.

This group consists of very deep, moderately well drained, silty and loamy soils. Available water capacity is low or moderate. Mosher soils are typical of this group.

Group 10. These soils generally are unsuited to woody plantings. The soils are shallow to bedrock, very shallow to gravel, very saline, very alkaline, or very wet. Specialized plantings for wildlife, recreation, or beautification may be established in some areas. The most favorable sites should be selected, and only those trees and shrubs that have the best potential to survive and grow should be planted.

The soils in this group have a wide range of texture, depth, drainage, available water capacity, permeability, and slope characteristics. The susceptibility to water erosion and wind erosion ranges from slight to very severe. Typical soils in this group are Albaton, Bullcreek, Capa, Herdcamp, Hoven, Kolls, Okaton, and Sansarc soils. Also included are the Lakoma, Opal, and Vivian soils that have steeper slopes.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local offices of the Natural Resources Conservation Service, the South Dakota Division of Forestry, the South Dakota Cooperative Extension Service, the South Dakota Agricultural Experiment Station, or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Connie M. Vicuna, biologist, Natural Resources Conservation Service, helped prepare this section.

Wildlife is an abundant resource in Jones County that provides diverse recreational opportunities. Many native species that require large tracts of rangeland, such as sharp-tailed grouse, prairie chicken, antelope, and mule deer (fig. 14), inhabit the county. Such species as pheasants and white-tailed deer, which benefit from agriculture and other farm related environments, are also common in some areas. Waterfowl have become more abundant because of stock dams. Woody cover along channels and in draws that drain into the Bad River, the White River, and Dry Creek provides the primary habitat for white-tailed deer, turkeys, beaver, and a small population of bobcats. These rivers, some large dams, and farm or stock ponds provide habitat for limited fisheries.

Soils affect the kind and amount of vegetation and water that is available to wildlife for food and cover. Therefore, they also affect the distribution and abundance of wildlife. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, by promoting natural establishment of desirable plants, and by providing suitable watering facilities.

Soil associations provide some indication of actual or potential distribution and density of wildlife and habitats because they represent a relatively uniform topographic unit with distinct capabilities to produce and maintain vegetation. Land use patterns and management practices are also more uniform within a

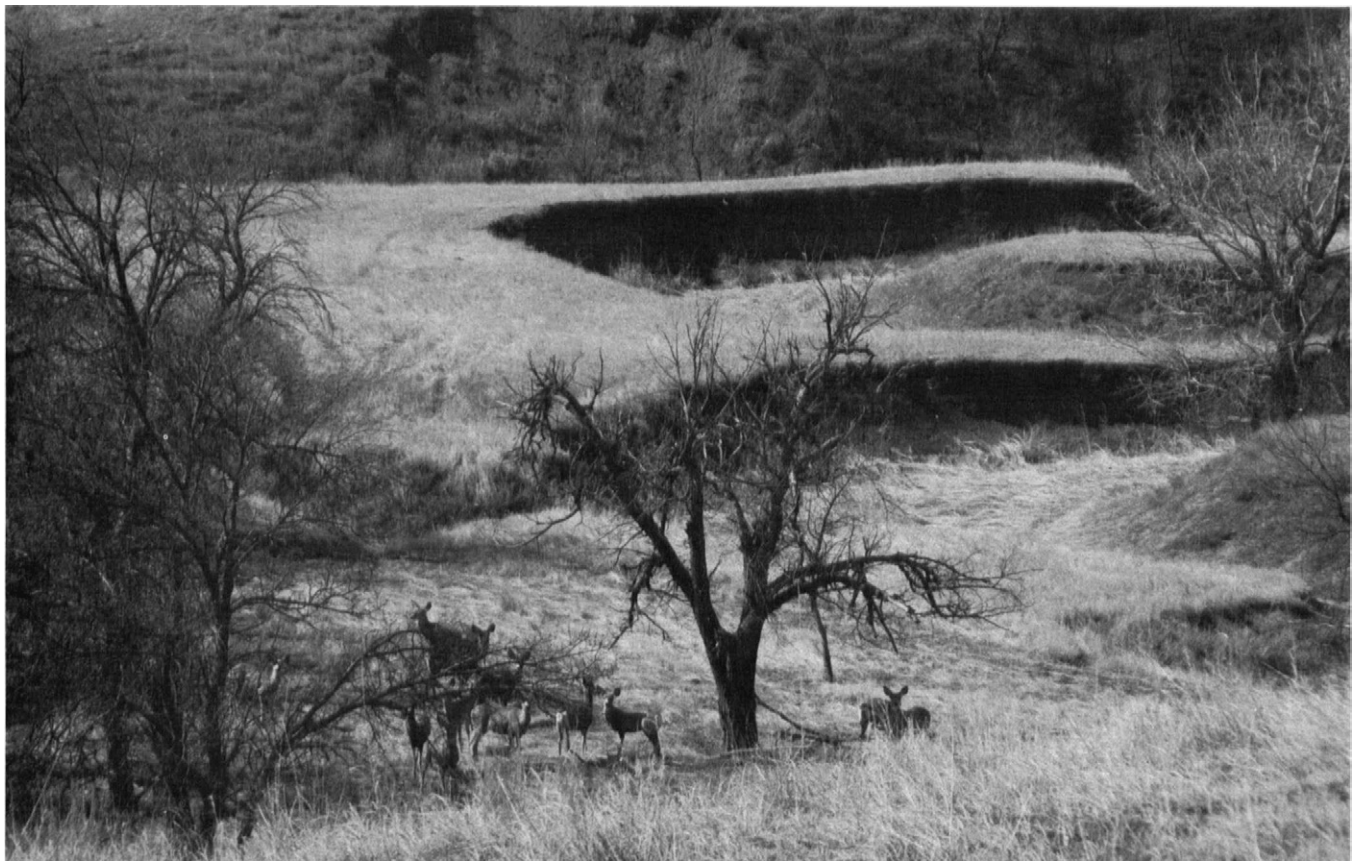

Figure 14.—Mule deer along a creek in a wooded area of Okaton-Wendte-Bullcreek complex, 0 to 45 percent slopes.

soil association. The 12 soil associations in Jones County are described under the heading "General Soil Map Units."

The soil associations can be grouped according to their relative potential for wildlife habitat. Wildlife species in these groups tend to be similar because of their preference for a particular habitat. One group includes the Nimbro-Bullcreek-Wendte association along the Bad River and the Bigbend-Hilmoe association along the White River. These associations contain most of the native woodland in the county. A second group includes the Lakoma-Okaton, Okaton-Lakoma, Opal-Sansarc, and Sansarc-Opal associations on river breaks and in the steeper areas throughout the county. These associations are mainly native rangeland. A third group includes the Promise, Millboro, Promise-Kirley, Kirley-Mosher, Kirley, and Kirley-Lakoma-Vivian associations. This group includes most of the cropland in the county.

Individual soils have different potentials for the development and maintenance of wildlife habitat elements. Therefore, the soil affects the degree or extent to which habitat can be established or improved. In table 10, the soils of Jones County are rated according to their potential for providing specific elements of wildlife habitat. This information can be used in planning parks, wildlife areas, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining the habitat elements; and in determining the intensity of management needed for each habitat element. The ratings, described in the following paragraphs, indicate the ease of establishing or maintaining these elements.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element. The element can be established, improved, or maintained in most places, but management is difficult and must be intensive. A

rating of *very poor* indicates that restrictions for the element are very severe and that unsatisfactory results can be expected. Establishing, improving, or maintaining the element is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are wheat and sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass, bromegrass, crested wheatgrass, clover, and alfalfa.

Native herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of native herbaceous plants are western wheatgrass, green needlegrass, big bluestem, little bluestem, blue grama, buffalograss, prairie-clover, and vetches.

Planted woody plants for windbreaks or other purposes require cultivation before and during establishment. They provide fruits, buds, bark, and foliage. Soil properties that affect the growth of trees and shrubs are depth of the root zone, available water capacity, salinity, and wetness. Examples of these plants are green ash, Russian-olive, plum, chokecherry, Rocky Mountain juniper, and eastern redcedar.

Native deciduous trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of these trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, cottonwood, green ash, elm, plum, and chokecherry.

Native coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are cedar and juniper.

Native shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are skunkbush sumac, gooseberry, western snowberry, buffaloberry, and sage.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are cattail, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

Additional information concerning maintaining and managing specific wildlife species is available at the local office of the Natural Resources Conservation Service, or the South Dakota Department of Game, Fish, and Parks, or the Wildlife and Fisheries Sciences Department at South Dakota State University.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not

eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrinking and swelling can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best

cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of about 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils only rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Reaction and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, salinity, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high clay content, soils that have only

20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and adsorption of nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by the cropping system, depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are established or maintained in permanent vegetation and are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

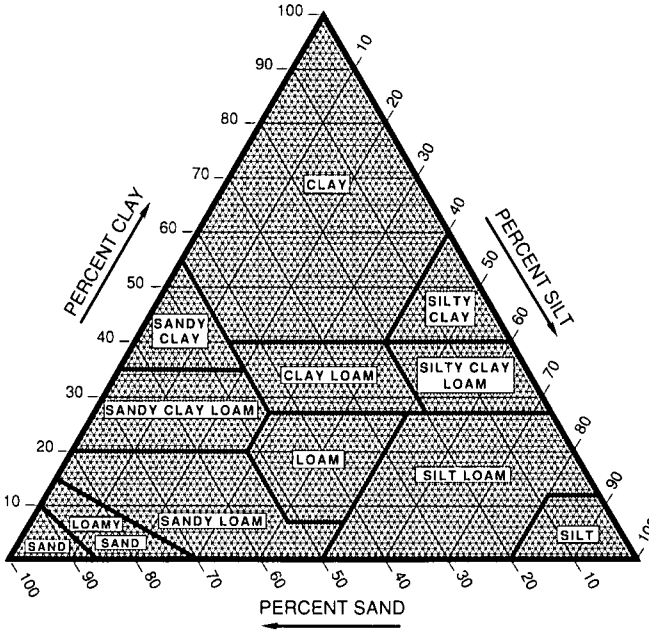

Figure 15.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 15). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to

those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields, in the design and management of irrigation systems, and in the development of nutrient and pesticide management plans.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown, in the selection of a tillage system, in decisions regarding crop residue management, and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH

of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in selecting pesticides, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. In Jones County, they range from 0.15 to 0.37. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop or range productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by limiting residue removal operations, by including high-residue producing crops in the rotation, and by applying agricultural waste to the soil. Agricultural waste should be applied in an environmentally acceptable manner. Organic matter affects the available water capacity, infiltration rate, pesticide efficiency and persistence, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep to very deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or

fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(9)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(10)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(9)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Albaton Series

Depth to bedrock: Very deep
Drainage class: Very poorly drained
Permeability: Slow

Landform: Flood plains
Parent material: Calcareous clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Albaton silty clay, depressional, 2,605 feet south and 1,938 feet west of the northeast corner of sec. 34, T. 3 S., R. 28 E.

A—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; few fine prominent brownish yellow (10YR 6/6) mottles; weak fine granular and weak medium subangular blocky structure; very hard, firm, very sticky and plastic; many roots; strong effervescence; slightly alkaline; abrupt smooth boundary.

Cg1—6 to 32 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many fine prominent reddish yellow (7.5YR 6/6) and few fine distinct gray (10YR 5/1) mottles; cleavage planes between thin strata form some weak medium platy structure, some of which parting to moderate coarse subangular blocky; very hard, firm, very sticky and plastic; common roots; strong effervescence; slightly alkaline; abrupt smooth boundary.

Cg2—32 to 43 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; many fine prominent reddish yellow (7.5YR 6/6) and common fine distinct gray (10YR 5/1) mottles; massive; very hard, firm, very sticky and plastic; few roots; strong effervescence; slightly alkaline; abrupt smooth boundary.

Cg3—43 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine prominent brown (7.5YR 4/4) and common fine distinct gray (10YR 5/1) mottles; massive; very hard, firm, very sticky and plastic; strong effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 6 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: More than 60 inches
Other features: Some pedons have coarser material below a depth of 40 inches.

A horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (3 moist)
Chroma—1 or 2
Texture—mainly silty clay; clay in some pedons

Cg horizon:
Hue—5Y or 2.5Y
Value—4 or 5 (3 or 4 moist)
Chroma—1 or 2
Texture—clay, silty clay, or silty clay loam

Bigbend Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Calcareous loamy alluvium
Slope: 0 to 1 percent

Typical Pedon

Bigbend silt loam (fig. 16), 1,840 feet west and 2,258 feet north of the southeast corner of sec. 1, T. 4 S., R. 28 E.

Ap—0 to 8 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; many roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C1—8 to 16 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; many roots; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—16 to 60 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; common roots to a depth of 25 inches, few roots to a depth of 40 inches; strong effervescence; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 2 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: More than 60 inches

A horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (3 to 5 moist)
Chroma—2 or 3
Texture—silt loam, silty clay loam, or very fine sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—2 or 3
Texture—very fine sandy loam or silt loam or strata of loamy fine sand, fine sandy loam, loam, and silty clay loam

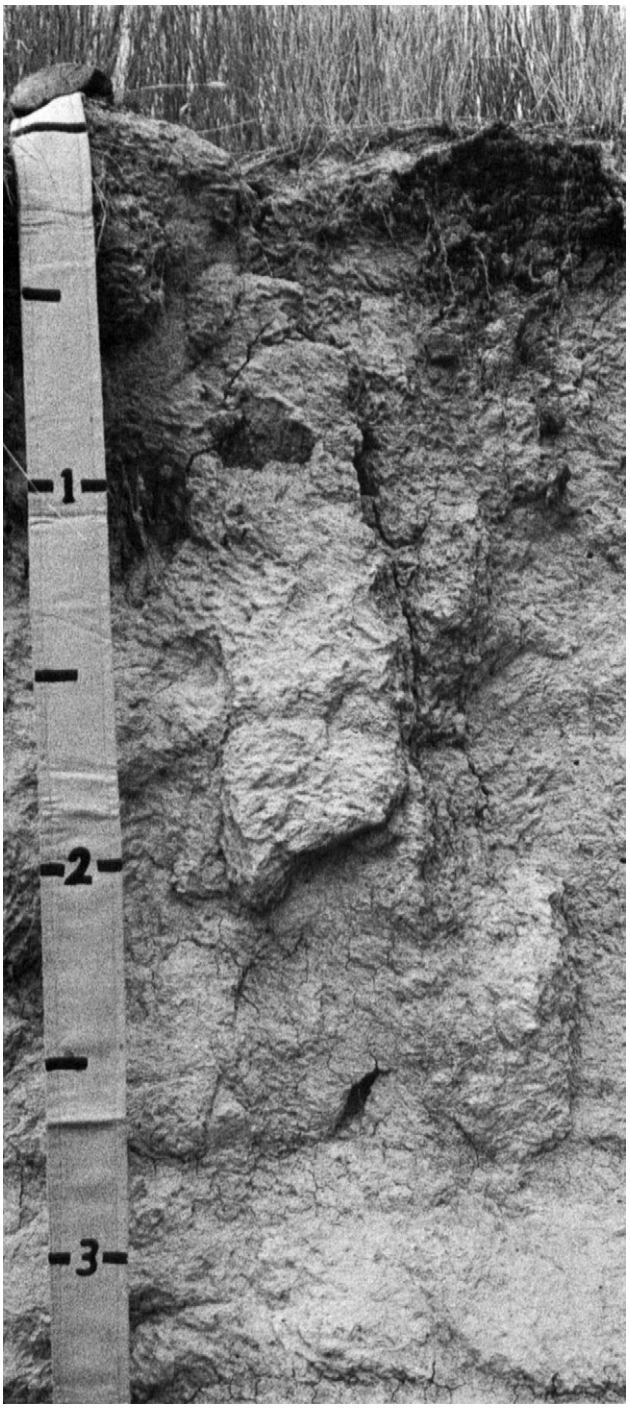

Figure 16.—Profile of Bigbend silt loam. Stratification begins at a depth of about 16 inches. Depth is marked in feet.

Bullcreek Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Very slow
Landform: Dissected plains, plains, fans, or terraces
Parent material: Clayey alluvium
Slope: 0 to 6 percent

Typical Pedon

Bullcreek clay, 0 to 6 percent slopes, 2,152 feet east and 2,018 feet north of the southwest corner of sec. 26, T. 2 N., R. 26 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate thin platy structure parting to moderate fine subangular blocky; very hard, firm, sticky and plastic; many roots; cracks 0.75 inch wide; neutral; abrupt smooth boundary.

Bw—3 to 7 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate very coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; many roots; cracks 0.5 inch wide; slightly alkaline; clear wavy boundary.

Bss—7 to 12 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak very coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common roots; cracks 0.5 inch wide; few nonintersecting slickensides; slickensides tilted 25 degrees from horizontal and 0.5 to 1.0 inch wide; slightly alkaline; clear wavy boundary.

Bssyz—12 to 25 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse subangular blocky structure; very hard, firm, sticky and plastic; common roots; cracks 0.25 inch wide; common prominent intersecting slickensides; slickensides tilted 30 degrees from horizontal and 0.5 inch to 2.0 inches wide; many fine masses of gypsum and other salts; slight effervescence; slightly alkaline; gradual wavy boundary.

Cyz1—25 to 38 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few roots to a depth of 30 inches; few fine masses of gypsum and other salts; slight effervescence; slightly alkaline; gradual wavy boundary.

Cyz2—38 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; common fine masses of gypsum and other salts; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 20 inches
Depth to contrasting or impervious layer: More than 60 inches

Depth to gypsum and other salts: 6 to 20 inches

A horizon:
Hue—2.5Y or 5Y
Value—4 or 5 (3 moist)
Chroma—1 or 2
Texture—mainly clay; silty clay in some pedons

B horizon:
Hue—2.5Y or 5Y
Value—4 to 6 (3 or 4 moist)
Chroma—2
Texture—clay

C horizon:
Hue—2.5Y or 5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—clay

Capa Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Plains and terraces
Parent material: Clayey residuum
Slope: 0 to 6 percent

Typical Pedon

Capa silt loam, 0 to 6 percent slopes, 2,373 feet east and 400 feet north of the southwest corner of sec. 36, T. 1 S., R. 27 E.

E—0 to 1 inch; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky and weak thin platy structure; soft, very friable; many roots; slightly acid; abrupt smooth boundary.

Btn1—1 to 4 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; light brownish gray (10YR 6/2) coatings on tops of columns; moderate coarse columnar structure parting to moderate medium and coarse subangular blocky; very hard, very firm, very sticky and plastic; few faint clay films on faces of peds; many roots; neutral; clear wavy boundary.

Btn2—4 to 11 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few faint clay films on faces of peds; many roots; slight effervescence; slightly alkaline; clear wavy boundary.

Btnkyz—11 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few faint clay films on faces of peds; common roots; common fine accumulations of carbonate; few fine masses of gypsum and other salts; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkyz1—15 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, firm, very sticky and plastic; common roots; common fine accumulations of carbonate; many fine masses of gypsum and other salts; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkyz2—24 to 31 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, firm, very sticky and plastic; few roots; common fine accumulations of carbonate; many fine accumulations of gypsum and other salts; strong effervescence; moderately alkaline; gradual wavy boundary.

Cy—31 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, very sticky and plastic; common fine accumulations of carbonate; many fine nests of gypsum; slight effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches
Depth to carbonates: 4 to 12 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 6 to 16 inches

E horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—1 or 2
Texture—mainly silt loam; loam in some pedons

Btn horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—clay

Btnkyz horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—1 or 2
Texture—clay

Bkyz horizon:
Hue—10YR, 2.5Y, or 5Y

Value—5 or 6 (4 or 5 moist)
Chroma—1 or 2
Texture—clay or silty clay

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—clay or silty clay

Herdcamp Series

Depth to bedrock: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Flood plains
Parent material: Clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Herdcamp silty clay, in an area of Herdcamp-Bullcreek complex, 1,970 feet east and 1,370 feet north of the southwest corner of sec. 7, T. 2 S., R. 28 E.

Azg—0 to 6 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; common dark gray (10YR 4/1) mottles; moderate fine granular structure; hard, friable, slightly sticky and plastic; many roots; many dark yellowish brown (10YR 4/4) and common olive brown (2.5Y 4/4) iron stains; common fine nests of gypsum and other salts; strong effervescence; moderately alkaline; clear smooth boundary.

Cyzg1—6 to 20 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; many dark gray (10YR 4/1) mottles; massive; slightly hard, firm, sticky and slightly plastic; common roots; many dark yellowish brown (10YR 4/4) iron stains; common fine nests of gypsum and other salts; strong effervescence; moderately alkaline; clear wavy boundary.

Cyzg2—20 to 60 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; common dark gray (N 4/0) mottles; massive; hard, firm, slightly sticky and plastic; common roots to a depth of 30 inches, few roots to a depth of 45 inches; common dark yellowish brown (10YR 4/4) and many olive brown (2.5Y 4/4) iron stains; common nests and striations of gypsum and other salts; slight effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 0 to 15 inches

A horizon:
Hue—2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—mainly silty clay; clay or silty clay loam in some pedons

C horizon:
Hue—2.5Y, 5Y, or neutral
Value—4 or 5 (3 or 4 moist)
Chroma—0 to 2
Texture—silty clay, clay, or silty clay loam

Hilmoe Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Slow
Landform: Flood plains
Parent material: Clayey over silty alluvium
Slope: 0 to 1 percent
Taxadjunct features: The Hilmoe soils in this county have mollic colors that are thinner than are defined as the range for the series. This difference, however, does not significantly alter the use or behavior of the soils.

Typical Pedon

Hilmoe silty clay (fig. 17), 1,563 feet west and 800 feet north of the southeast corner of sec. 33, T. 3 S., R. 28 E.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse subangular blocky structure parting to moderate fine granular; hard, friable, slightly sticky and plastic; many roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

C1—7 to 16 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, slightly sticky and plastic; many roots; weak bedding planes; violent effervescence; slightly alkaline; gradual wavy boundary.

C2—16 to 30 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse subangular blocky structure; very hard, firm, slightly sticky and plastic; common roots; weak bedding planes; violent effervescence; slightly alkaline; abrupt wavy boundary.

2C—30 to 60 inches; light gray (2.5Y 7/2) silt loam

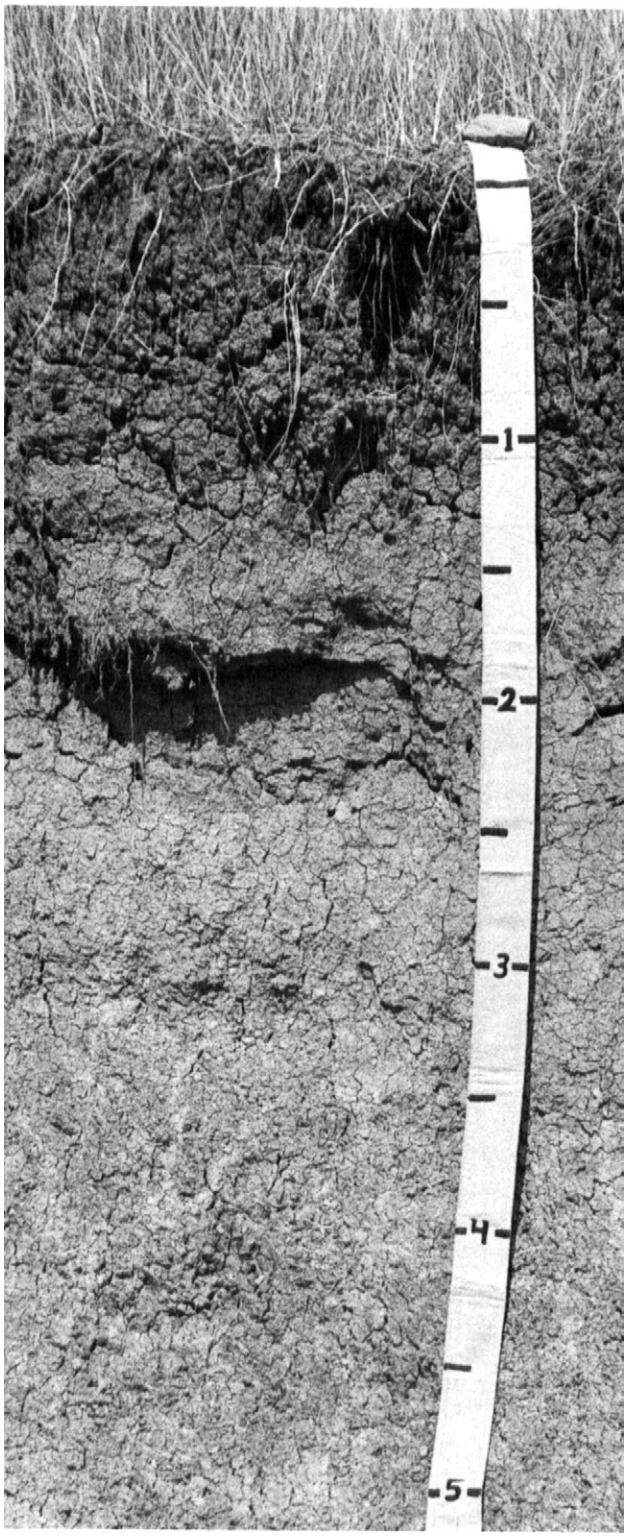

Figure 17.—Profile of Hilmoe silty clay. Stratified clayey layers are over loamy layers at a depth of about 30 inches. Depth is marked in feet.

stratified with thin layers of very fine sandy loam and clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; violent effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 20 inches
Depth to carbonates: 0 to 3 inches
Depth to contrasting or impervious layer: 20 to 40 inches over silty alluvium
Depth to gypsum and other salts: 10 to more than 60 inches

A horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly silty clay or silt loam; silty clay loam in some pedons

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (3 or 4 moist)
Chroma—1 or 2
Texture—mainly silty clay or clay; silty clay loam in some pedons

2C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—mainly silt loam, loam, or very fine sandy loam; fine sandy loam or clay loam in some pedons

Hoven Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Very slow
Landform: Plains
Parent material: Clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Hoven silt loam, 80 feet west and 168 feet north of the southeast corner of sec. 27, T. 2 N., R. 27 E.

E—0 to 4 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; few fine distinct brown (10YR 4/3) mottles; moderate thin platy structure; slightly hard, very friable; many roots; moderately acid; abrupt smooth boundary.
Btn1—4 to 8 inches; dark grayish brown (2.5Y 4/2)

clay, very dark grayish brown (2.5Y 3/2) moist; continuous gray (10YR 6/1) coatings on tops of columns and thin coatings on vertical faces of peds; moderate coarse columnar structure parting to strong medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; many roots; few small pebbles; slightly acid; gradual wavy boundary.

Btn2—8 to 23 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; extremely hard, firm, sticky and plastic; shiny films on faces of peds; common roots; few pebbles; neutral; gradual wavy boundary.

Bk—23 to 35 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common roots; few fine accumulations of carbonate; few pebbles; slight effervescence; moderately alkaline; gradual wavy boundary.

Cyz1—35 to 46 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few roots to a depth of 40 inches; few fine accumulations of carbonate; few fine masses of gypsum and other salts; few pebbles; slight effervescence; moderately alkaline; gradual wavy boundary.

Cyz2—46 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; many fine masses and threads of gypsum; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 35 inches
Depth to carbonates: 10 to 30 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 20 to 45 inches

E horizon:
Hue—10YR
Value—5 to 7 (3 or 4 moist)
Chroma—1 or 2
Texture—silt loam

Btn horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—silty clay or clay

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (3 or 4 moist)
Chroma—1 or 2
Texture—silty clay or clay

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—1 or 2
Texture—silty clay or clay

Inavale Series

Depth to bedrock: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Flood plains
Parent material: Sandy alluvium
Slope: 0 to 1 percent

Typical Pedon

Inavale loamy fine sand, 100 feet west and 1,705 feet south of the northeast corner of sec. 3, T. 4 S., R. 30 E.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many roots; neutral; clear smooth boundary.

AC—4 to 8 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; single grain; soft, loose; common roots; slight effervescence; slightly alkaline; clear wavy boundary.

C—8 to 60 inches; light gray (10YR 7/2) fine sand stratified with thin layers of loamy fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; common roots to a depth of 25 inches, few roots to a depth of 40 inches; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 4 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: More than 60 inches
Other features: Some pedons do not have an AC horizon.

A horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—1 or 2
Texture—mainly loamy fine sand; fine sandy loam or loamy sand in some pedons

C horizon:
Hue—10YR
Value—5 to 7 (4 to 6 moist)

Chroma—2 or 3
Texture—fine sand

Kirley Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Terraces and dissected plains
Parent material: Loamy alluvium
Slope: 0 to 15 percent

Typical Pedon

Kirley clay loam, 2 to 6 percent slopes, 1,390 feet south and 695 feet west of the northeast corner of sec. 5, T. 1 S., R. 27 E.

Ap—0 to 6 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; neutral; abrupt smooth boundary.

Bt1—6 to 12 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, friable, sticky and plastic; shiny films on faces of peds; many roots; slightly acid; clear wavy boundary.

Bt2—12 to 18 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong coarse subangular blocky; hard, firm, sticky and plastic; shiny films on faces of peds; common roots; slightly acid; clear wavy boundary.

Btk—18 to 25 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate coarse subangular blocky; hard, friable, very sticky and plastic; shiny films on faces of peds; common roots; few fine accumulations of carbonate; strong effervescence; slightly alkaline; clear wavy boundary.

Bk—25 to 40 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, sticky and slightly plastic; few roots; many medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—40 to 52 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and slightly plastic; few roots; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—52 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, very sticky; few roots; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 18 inches
Depth to carbonates: 12 to 20 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: More than 60 inches

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—clay loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—mainly clay or clay loam; sandy clay in some pedons

Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam or clay

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam or clay

Kolls Series

Depth to bedrock: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Very slow
Landform: Plains
Parent material: Clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Kolls silty clay, 200 feet north and 350 feet east of the southwest corner of sec. 18, T. 1 N., R. 30 E.

A—0 to 3 inches; dark gray (10YR 4/1) silty clay, very

dark gray (10YR 3/1) moist; weak fine granular and weak fine subangular blocky structure; very hard, firm, sticky and plastic; common cracks about 0.5 inch wide; many roots; slight effervescence; neutral; clear wavy boundary.

Bg—3 to 12 inches; dark gray (N 4/0) clay, very dark gray (N 3/0) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, very firm, sticky and plastic; common cracks about 0.5 inch wide; many roots; strong effervescence; slightly alkaline; clear wavy boundary.

Bssg—12 to 23 inches; gray (N 5/0) clay, dark gray (N 4/0) moist; weak very coarse subangular blocky structure parting to weak coarse subangular blocky; extremely hard, very firm, sticky and plastic; common cracks about 0.5 inch wide; many roots; many distinct intersecting slickensides; strong effervescence; moderately alkaline; gradual wavy boundary.

BCssyzg—23 to 31 inches; gray (N 5/0) clay, dark gray (N 4/0) moist; weak very coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; common cracks about 0.5 inch wide; common roots; few distinct nonintersecting slickensides; common fine masses of gypsum and other salts; strong effervescence; strongly alkaline; gradual wavy boundary.

Cssyzg—31 to 42 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, very firm, sticky and plastic; few roots; few distinct nonintersecting slickensides; few fine masses of gypsum and other salts; strong effervescence; strongly alkaline; gradual wavy boundary.

Cyzg—42 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; extremely hard, very firm, sticky and plastic; few fine masses of gypsum and other salts; strong effervescence; strongly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 30 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—4 or 5 (2 or 3 moist)
Chroma—0 or 1
Texture—mainly silty clay; clay in some pedons

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—4 or 5 (2 or 3 moist)
Chroma—0 or 1
Texture—clay

Bssg or Bssyzg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—5 or 6 (4 or 5 moist)
Chroma—0 or 1
Texture—clay

Cg horizon:
Hue—2.5Y, 5Y, or neutral
Value—4 to 6 (3 to 5 moist)
Chroma—0 to 3
Texture—clay

Lakoma Series

Depth to bedrock: Moderately deep
Drainage class: Well drained
Permeability: Slow
Landform: Dissected plains
Parent material: Clayey residuum
Slope: 3 to 25 percent

Typical Pedon

Lakoma silty clay, 6 to 15 percent slopes, 2,607 feet east and 1,236 feet north of the southwest corner of sec. 7, T. 1 N., R. 26 E.

A—0 to 5 inches; dark grayish brown (2.5Y 4/2) crushing to grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, sticky and slightly plastic; many roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bw1—5 to 10 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, sticky and slightly plastic; many roots; strong effervescence; slightly alkaline; gradual wavy boundary.

Bw2—10 to 17 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and plastic; common roots; strong effervescence; slightly alkaline; gradual wavy boundary.

Bk—17 to 26 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak

coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and plastic; common roots; few fine accumulations of carbonate; about 10 percent fragments of shale; strong effervescence; moderately alkaline; clear wavy boundary.

C—26 to 36 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; few roots; about 40 percent fragments of shale; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—36 to 60 inches; pale yellow (2.5Y 7/4) shale, light olive brown (2.5Y 5/4) moist; many light olive brown (2.5Y 5/6) iron stains; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 7 inches
Depth to contrasting or impervious layer: 20 to 40 inches over shale
Depth to gypsum and other salts: 20 to 40 inches

A horizon:
Hue—2.5Y or 10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—mainly silty clay; clay in some pedons

Bw horizon:
Hue—2.5Y or 10YR
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—silty clay or clay

Bk horizon:
Hue—2.5Y or 10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—silty clay or clay

C horizon:
Hue—2.5Y or 10YR
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—silty clay or clay

Cr horizon:
Hue—2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 or 3
Texture—shale

Millboro Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Slow
Landform: Plains
Parent material: Clayey residuum
Slope: 0 to 9 percent

Typical Pedon

Millboro silty clay loam, 0 to 3 percent slopes, 1,905 feet east and 1,454 feet south of the northwest corner of sec. 11, T. 3 S., R. 30 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky and weak fine granular structure; hard, friable, sticky and plastic; common roots; slight effervescence; neutral; abrupt smooth boundary.

A—5 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common roots; strong effervescence; slightly alkaline; clear smooth boundary.

Bt—9 to 18 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; common dark gray (10YR 4/1) tongues of the A horizon; common roots; strong effervescence; slightly alkaline; clear wavy boundary.

Bkss1—18 to 25 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm, sticky and plastic; common dark gray (10YR 4/1) tongues of the A horizon; few faint nonintersecting slickensides; few roots; common fine accumulations of carbonate; strong effervescence; slightly alkaline; granular wavy boundary.

Bkss2—25 to 29 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; very hard, firm, sticky and plastic; common dark gray (10YR 4/1) tongues of the A horizon; weak coarse subangular blocky structure; few faint nonintersecting slickensides; few roots; few fine accumulations of carbonate; strong effervescence; slightly alkaline; gradual wavy boundary.

Css—29 to 39 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; common dark gray (10YR 4/1) tongues of the A horizon; common faint nonintersecting slickensides; few

roots; strong effervescence; slightly alkaline; gradual wavy boundary.

Cyz—39 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; many fine masses of gypsum and other salts; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 15 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 36 to more than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly silty clay loam; silty clay or clay in some pedons

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (3 or 4 moist)
Chroma—1 or 2
Texture—silty clay or clay

Bk horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—silty clay or clay

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—silty clay or clay

Mosher Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Terraces
Parent material: Loamy alluvium
Slope: 0 to 2 percent

Typical Pedon

Mosher silt loam, in an area of Kirley-Mosher complex, 0 to 6 percent slopes, 347 feet west and 313 feet south of the northeast corner of sec. 8, T. 2 N., R. 31 E.

A—0 to 3 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable; many roots; slightly acid; clear smooth boundary.

E—3 to 6 inches; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable; many roots; moderately acid; abrupt wavy boundary.

Btn1—6 to 11 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; thin continuous light gray (10YR 6/1) coatings on tops of columns and thin coatings on vertical faces of peds; moderate medium and coarse columnar structure; extremely hard, firm, sticky and slightly plastic; shiny films on faces of peds; many roots; neutral; clear wavy boundary.

Btn2—11 to 25 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; extremely hard, firm, sticky and slightly plastic; shiny films on faces of peds; many roots; slight effervescence; moderately alkaline; gradual wavy boundary.

Bkyz1—25 to 40 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, firm, sticky and slightly plastic; common roots to a depth of 30 inches, few roots to a depth of 40 inches; common fine accumulations of carbonate; few fine masses of gypsum and other salts; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkyz2—40 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and slightly plastic; common fine accumulations of carbonate; common fine masses of gypsum and other salts; violent effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 10 to 20 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 16 to 30 inches
Other features: Some pedons have a C horizon.

A horizon:
Hue—10YR
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2

Texture—mainly silt loam; loam in some pedons

E horizon:
Hue—10YR
Value—5 to 7 (3 or 4 moist)
Chroma—1 or 2
Texture—mainly silt loam; loam in some pedons

Btn horizon:
Hue—10YR
Value—3 to 5 (2 to 4 moist)
Chroma—1 or 2
Texture—clay, silty clay, or clay loam

Bkyz or Bkz horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 3
Texture—silty clay or clay

Nimbro Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Calcareous loamy alluvium
Slope: 0 to 1 percent

Typical Pedon

Nimbro silty clay loam, 332 feet east and 930 feet south of the northwest corner of sec. 26, T. 2 N., R. 26 E.

Ap—0 to 7 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak thin platy structure; slightly hard, friable; many roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

C1—7 to 20 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable; many roots; strong effervescence; slightly alkaline; clear wavy boundary.

C2—20 to 60 inches; light brownish gray (2.5Y 6/2) clay loam stratified with thin layers of fine sand, grayish brown (2.5Y 5/2) moist; slightly hard, friable; common roots to a depth of 40 inches, few roots to a depth of 50 inches; strong effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 3 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: More than 60 inches

Ap horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly silty clay loam; loam in some pedons

C horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (3 to 5 moist)
Chroma—2 to 4
Texture—mainly clay loam, silty clay loam, or silt loam stratified with thin layers of fine sand; thin layers of fine sand to clay in some pedons

Okaton Series

Depth to bedrock: Shallow
Drainage class: Well drained
Permeability: Slow
Landform: Dissected plains
Parent material: Clayey residuum
Slope: 6 to 60 percent

Typical Pedon

Okaton silty clay, in an area of Okaton-Lakoma silty clays, 15 to 40 percent slopes, 1,620 feet north and 50 feet west of the southeast corner of sec. 26, T. 2 N., R. 28 E.

A—0 to 2 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky; many roots; strong effervescence; slightly alkaline; gradual smooth boundary.

AC—2 to 8 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky and weak coarse granular structure; hard, friable, sticky and slightly plastic; many fine roots; common fine fragments of shale; strong effervescence; slightly alkaline; gradual wavy boundary.

C—8 to 14 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; 70 percent, by volume, fragments of shale; few fine accumulations of carbonate; strong effervescence; slightly alkaline; clear smooth boundary.

Cr1—14 to 21 inches; grayish brown (2.5Y 5/2) fractured shale, dark grayish brown (2.5Y 4/2) moist; thin seams of yellowish brown (10YR 5/6)

between shale plates, dark yellowish brown (10YR 4/6) moist; rock structure evident; easily dug with spade; common fine and medium roots; slight effervescence; slightly alkaline; clear smooth boundary.

Cr2—21 to 30 inches; light brownish gray (2.5Y 6/2) bedded shale, dark grayish brown (2.5Y 4/2) moist; thin seams of light yellowish brown (10YR 6/4) between shale plates, yellowish brown (10YR 5/4) moist; rock structure evident; easily dug with spade; common fine nests of gypsum in seams; slight effervescence; slightly alkaline; gradual smooth boundary.

Cr3—30 to 60 inches; light brownish gray (2.5Y 6/2) bedded shale, dark grayish brown (2.5Y 4/2) moist; thin seams of light yellowish brown (2.5Y 6/4) between plates, olive brown (2.5Y 4/4) moist; easily dug with spade; slight effervescence; moderately alkaline.

Range in Characteristics

Depth to carbonates: At or near the surface
Depth to contrasting or impervious layer: 10 to 20 inches over shale
Depth to gypsum and other salts: 8 to more than 60 inches
Other features: The underlying bedded shale contains seams of gypsum, lime, and other salts.

A horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (3 to 5 moist)
Chroma—2 to 4
Texture—mainly silty clay; clay in some pedons

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—silty clay or clay

Cr horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—shale

Opal Series

Depth to bedrock: Moderately deep
Drainage class: Well drained
Permeability: Very slow
Landform: Dissected plains
Parent material: Clayey residuum
Slope: 0 to 25 percent

Typical Pedon

Opal clay, 3 to 6 percent slopes, 1,585 feet east and 2,508 feet south of the northwest corner of sec. 28, T. 1 S., R. 29 E.

A—0 to 2 inches; grayish brown (10YR 5/2) clay, very dark gray (10YR 3/1) moist; moderate medium and fine granular structure; slightly hard, friable, sticky and plastic; many fine and medium roots; slightly alkaline; clear smooth boundary.

Bss1—2 to 10 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse subangular blocky structure; very hard, firm, very sticky and very plastic; many fine and medium roots; common distinct nonintersecting slickensides; cracks 0.5 inch wide; 1 percent pebbles; slight effervescence; neutral; clear wavy boundary.

Bss2—10 to 16 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, firm, very sticky and very plastic; common fine and medium roots; many prominent intersecting slickensides; cracks 1 inch wide; 1 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

Bkss—16 to 26 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, firm, very sticky and very plastic; few fine roots; many prominent intersecting slickensides; cracks 0.5 to 1.0 inch wide; many fine and medium accumulations of carbonate; 1 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

Cyz1—26 to 30 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; many fine prominent yellowish brown (10YR 5/6) mottles; massive; very hard, firm, very sticky and very plastic; many fine nests of gypsum and other salts; 1 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

Cyz2—30 to 35 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine prominent strong brown (7.5YR 5/6) and common fine prominent yellowish brown (10YR 5/6) mottles; massive; hard, friable, very sticky and very plastic; many fine and medium masses of gypsum and other salts; about 55 percent

fragments of shale; strong effervescence; moderately alkaline; clear wavy boundary.

Cr1—35 to 41 inches; light brownish gray (2.5Y 6/2) and dark gray (5Y 4/1) shale, dark grayish brown (2.5Y 4/2) moist; common fine prominent strong brown (7.5YR 5/6) mottles; many yellowish brown (10YR 5/6) iron stains in cracks and seams; many fine nests of gypsum and other salts; strong effervescence; slightly alkaline; gradual wavy boundary.

Cr2—41 to 60 inches; light brownish gray (2.5Y 6/2) and dark gray (5Y 4/1) shale, dark grayish brown (2.5Y 4/2) moist; common fine prominent strong brown (7.5YR 5/6) mottles; many yellowish brown (10YR 5/6) iron stains along seams and cracks; few fine nests of gypsum and other salts; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 8 inches
Depth to contrasting or impervious layer: 20 to 40 inches over shale
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly clay or clay loam; silty clay in some pedons

Bss horizon:
Hue—2.5Y or 5Y
Value—4 to 6 (2 to 4 moist)
Chroma—2 or 3
Texture—clay

Bkss horizon:
Hue—2.5Y or 5Y
Value—4 to 6 (3 to 5 moist)
Chroma—2 to 4
Texture—clay

C horizon:
Hue—2.5Y or 5Y
Value—5 or 6 (4 or 5 moist)
Chroma—1 to 3
Texture—clay

Cr horizon:
Hue—2.5Y or 5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—shale

Promise Series

Depth to bedrock: Deep and very deep
Drainage class: Well drained
Permeability: Very slow
Landform: Plains
Parent material: Clayey residuum
Slope: 0 to 9 percent

Typical Pedon

Promise clay, 0 to 3 percent slopes (fig. 18), 135 feet west and 2,140 feet north of the southeast corner of sec. 5, T. 1 S., R. 29 E.

Ap1—0 to 2 inches; dark grayish brown (10YR 4/2) clay, very dark gray (10YR 3/1) crushing to very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; many roots; cracks 0.5 inch wide; slight effervescence; slightly alkaline; abrupt smooth boundary.

Ap2—2 to 5 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; hard, firm, sticky and plastic; many roots; cracks 0.5 inch wide; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bss1—5 to 10 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; common roots; cracks 0.5 inch wide; few distinct nonintersecting slickensides; slickensides tilted 30 degrees from horizontal and 0.5 inch to 2.0 inches wide; slight effervescence; slightly alkaline; clear wavy boundary.

Bss2—10 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse and very coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; many dark grayish brown (10YR 4/2) tongues of the A horizon; common roots; cracks 0.5 inch wide; common prominent intersecting slickensides; slickensides tilted 30 degrees from horizontal and 1 inch to 4 inches wide; slight effervescence; slightly alkaline; gradual wavy boundary.

Bss3—20 to 26 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; many dark grayish brown (10YR 4/2) tongues of the A

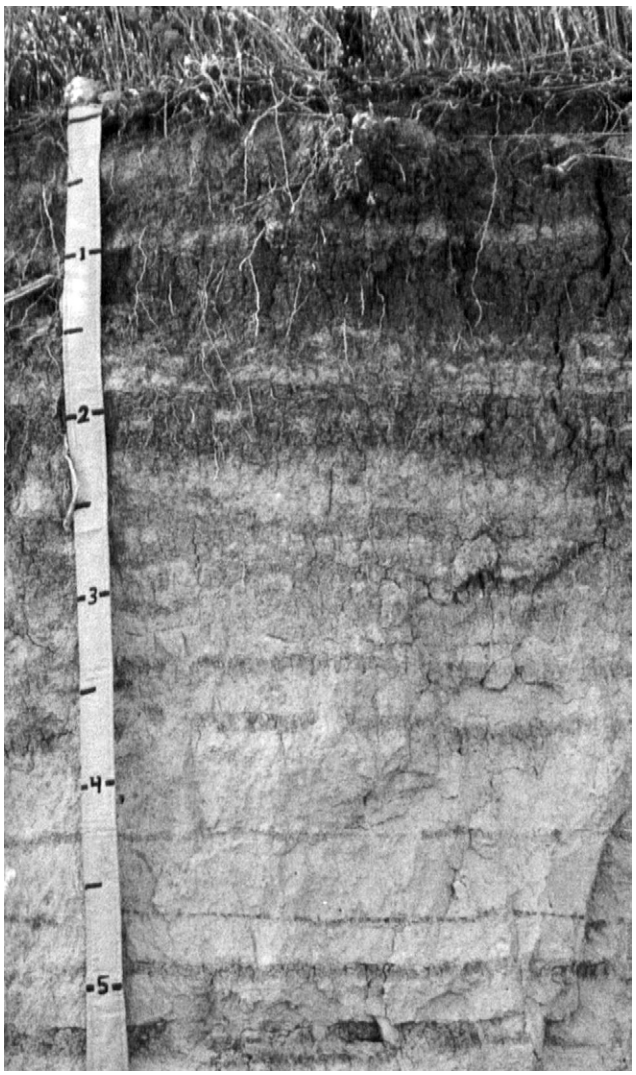

Figure 18.—Profile of Promise clay. Cracks occur in the soil. Depth is marked in feet.

horizon; common roots; cracks 0.25 inch wide; common prominent intersecting slickensides; slickensides tilted 35 degrees from horizontal and 0.5 inch to 6.0 inches wide; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkss—26 to 34 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; many dark grayish brown (10YR 4/2) tongues of the A horizon; common roots; cracks 0.25 inch wide; few prominent nonintersecting slickensides; slickensides tilted 35 degrees from horizontal and 0.5 inch to 2.0 inches wide; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—34 to 40 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; few roots; strong effervescence; moderately alkaline; clear wavy boundary.

Cyz—40 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; many fine accumulations of carbonate; many fine and medium masses of gypsum and other salts; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 15 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over shale
Depth to gypsum and other salts: 25 to 45 inches

A horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly clay; silty clay in some pedons

Bss horizon:
Hue—2.5Y or 5Y
Value—4 to 6 (2 to 4 moist)
Chroma—2 to 4
Texture—clay

Bkss horizon:
Hue—2.5Y or 5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—clay

C horizon:
Hue—2.5Y or 5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—clay or silty clay

Ree Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Terraces
Parent material: Loamy alluvium
Slope: 0 to 9 percent

Typical Pedon

Ree loam, 0 to 2 percent slopes, 1,760 feet south and 1,030 feet east of the northwest corner of sec. 34, T. 2 N., R. 26 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common roots; slightly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; dark grayish brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; shiny films on faces of peds; common roots; neutral; gradual wavy boundary.

Bt2—13 to 23 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to strong medium and coarse subangular blocky; hard, friable; shiny films on faces of peds; few roots; slight effervescence; neutral; gradual wavy boundary.

Bk1—23 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, very friable; few roots; many medium accumulations of carbonate; violent effervescence; slightly alkaline; clear wavy boundary.

Bk2—36 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable; few roots; common medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—42 to 60 inches; light yellowish brown (2.5Y 6/4) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; few roots to a depth of 50 inches; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 12 to 30 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: More than 60 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly loam; silt loam or fine sandy loam in some pedons

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (2 to 4 moist)
Chroma—1 to 4
Texture—mainly clay loam; silty clay loam or sandy clay loam in some pedons

Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam, clay loam, or fine sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—mainly loam, clay loam, or sandy loam; sandy material, sand or gravel, or clay material below a depth of 40 to 60 inches in some pedons

Sansarc Series

Depth to bedrock: Shallow
Drainage class: Well drained
Permeability: Slow
Landform: Dissected plains
Parent material: Clayey residuum
Slope: 9 to 40 percent

Typical Pedon

Sansarc clay, in an area of Sansarc-Opal clays, 9 to 40 percent slopes, 2,357 feet west and 996 feet north of the southeast corner of sec. 28, T. 2 N., R. 26 E.

A—0 to 3 inches; olive gray (5Y 4/2) clay, dark olive gray (5Y 3/2) moist; moderate fine granular structure; hard, friable, sticky and plastic; many roots; slight effervescence; slightly alkaline; clear smooth boundary.

AC—3 to 10 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak very coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, sticky and plastic; many roots; about 40 percent fragments of shale; strong effervescence; slightly alkaline; gradual wavy boundary.

C—10 to 14 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; common roots; few fine masses

of iron; about 60 percent fragments of shale; slight effervescence; slightly alkaline; gradual wavy boundary.

Cr—14 to 60 inches; light olive gray (5Y 6/2) shale, olive gray (5Y 4/2) moist; few roots to a depth of 40 inches; shale can be dug easily by a spade, but plates are hard and brittle when dry; few fine masses of iron; few fine masses of gypsum and other salts; slight effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 3 inches
Depth to contrasting or impervious layer: 10 to 20 inches over shale
Depth to gypsum and other salts: 10 to more than 60 inches
Other features: The underlying bedded shale contains seams of gypsum, lime, and other salts.

A horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 5 moist)
Chroma—1 to 3
Texture—mainly clay; silty clay in some pedons

AC horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—clay

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—clay

Cr horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—shale

Vivian Series

Depth to bedrock: Deep
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid above the shale
Landform: Terraces
Parent material: Outwash sediments
Slope: 2 to 40 percent

Typical Pedon

Vivian gravelly loam, in an area of Lakoma-Vivian complex, 9 to 25 percent slopes, 995 feet east and 400 feet south of the northwest corner of sec. 5, T. 1 N., R. 27 E.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; many roots; about 15 percent gravel; violent effervescence; slightly alkaline; clear smooth boundary.

C1—4 to 9 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable; common roots; about 40 percent gravel; violent effervescence; slightly alkaline; gradual wavy boundary.

C2—9 to 50 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; loose; common roots to a depth of 35 inches, few roots to a depth of 42 inches; about 55 percent gravel; violent effervescence; moderately alkaline; abrupt wavy boundary.

2Cr—50 to 60 inches; pale yellow (2.5Y 7/4) shale, light olive brown (2.5Y 5/4) moist; brittle; strong effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 4 inches
Depth to contrasting or impervious layer: 40 to 60 inches over shale
Depth to gypsum and other salts: More than 60 inches

A horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (4 or 5 moist)
Chroma—2 to 4
Texture—mainly gravelly loam; gravelly clay loam, loam, or very gravelly loam in some pedons

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—very gravelly loam, very gravelly clay loam, very gravelly fine sandy loam, or extremely gravelly loam

2Cr horizon:
Hue—2.5Y
Value—6 or 7 (5 or 6 moist)
Chroma—2 to 4
Texture—shale

Wendte Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained

Permeability: Slow
Landform: Flood plains
Parent material: Calcareous clayey alluvium
Slope: 0 to 2 percent

Typical Pedon

Wendte silty clay, channeled, 830 feet west and 100 feet north of the southeast corner of sec. 1, T. 1 S., R. 28 E.

A—0 to 6 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; many roots; slight effervescence; slightly alkaline; clear smooth boundary.

C1—6 to 17 inches; grayish brown (2.5Y 5/2) clay loam with few thin strata of coarser textured material, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many roots; common fine shale chips; slight effervescence; slightly alkaline; abrupt wavy boundary.

C2—17 to 47 inches; grayish brown (2.5Y 5/2) clay loam with few thin strata of coarser textured material, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; common roots; few fine shale chips; slight effervescence; slightly alkaline; gradual wavy boundary.

C3—47 to 60 inches; light brownish gray (2.5Y 6/2) clay loam with few thin strata of coarser textured material, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few roots; strong effervescence; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 6 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly silty clay; clay, silty clay loam, or clay loam in some pedons

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 to 4
Texture—clay, clay loam, or silty clay with thin strata of coarser textured material

Witten Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Slow
Landform: Plains
Parent material: Clayey alluvium
Slope: 0 to 3 percent

Typical Pedon

Witten silty clay, 67 feet south and 2,506 feet west of the northeast corner of sec. 35, T. 1 N., R. 30 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable, sticky and plastic; many roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

A—5 to 12 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak very coarse prismatic structure parting to moderate medium and coarse blocky; hard, friable, sticky and plastic; many roots; slight effervescence; slightly alkaline; clear smooth boundary.

Btss1—12 to 22 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak very coarse subangular blocky structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny films on faces of peds; many roots; common distinct nonintersecting slickensides; slickensides tilted 20 degrees from horizontal and 0.5 inch to 2.0 inches wide; slight effervescence; slightly alkaline; gradual wavy boundary.

Btss2—22 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny films on faces of peds; common roots; many prominent intersecting slickensides; slickensides tilted 20 degrees from horizontal and 1 inch to 4 inches wide; strong effervescence; slightly alkaline; gradual wavy boundary.

BCssk—32 to 49 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; common very dark gray (10YR 3/1) tongues of the A horizon; few roots; few distinct nonintersecting slickensides; slickensides

tilted 20 degrees from horizontal and 1 inch to 4 inches wide; few fine accumulations of carbonate; strong effervescence; slightly alkaline; clear wavy boundary.

Cyz—49 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; hard, firm, sticky and plastic; common very dark gray (10YR 3/1) tongues of the A horizon; many fine masses of gypsum and other salts; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 34 inches
Depth to carbonates: 0 to 15 inches
Depth to contrasting or impervious layer: More than 60 inches
Depth to gypsum and other salts: 30 to 50 inches

A horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—mainly silty clay; clay in some pedons

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1 or 2
Texture—silty clay or clay

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—silty clay or clay

Formation of the Soils

Soil forms when chemical and physical processes act on geologically deposited or accumulated material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are modified by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Generally, a long time is required for development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Jones County.

Climate

Climate directly influences the rate of chemical and physical weathering. Jones County has a continental climate marked by cold winters and hot summers *(5)*. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil profile. It also favors a moderately slow rate of weathering or soil formation. Detailed information about the climate is given under the heading "General Nature of the County."

Plant and Animal Life

Plants, animals, insects, earthworms, bacteria, actinomycetes, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Jones County the prairie grasses have had more influence than other living organisms on soil formation. As a result of these grasses, the surface layer of many of the soils has a moderate content of organic matter. The gently sloping Promise soils contain more organic matter than the more sloping Sansarc soils because they have a more extensive grass cover.

Earthworms, insects, and burrowing animals help keep the soil open and porous. Bacteria, actinomycetes, and fungi decompose plant residue, thus releasing plant nutrients.

Parent Material

Parent material is the unconsolidated organic and mineral material in which a soil forms. It determines many of the chemical and physical characteristics of the soil, such as color, texture, reaction, and consistence. The rate of soil formation is more rapid in the more friable, loamy parent material than in the firm, clayey parent material. Also, more changes take place in the more friable, loamy parent material, and the soils develop more distinct horizons. Most of the soils in Jones County formed in material weathered from the underlying bedrock. The rest formed in old alluvial deposits on high terraces or in recent alluvial deposits on flood plains, on foot slopes, and in basins on uplands.

The Pierre Shale Formation is the major geological formation in Jones County *(7)*. It underlies the entire county. It is light brownish gray to pale yellow and has seams of bentonite, gypsum, and concretions of iron and manganese. Bullcreek, Capa, Lakoma, Millboro, Okaton, Opal, Promise, Sansarc, and Witten soils formed in material weathered from the Pierre Shale Formation.

Alluvium is recently deposited, sandy to clayey material on flood plains and older deposits of loamy material on high terraces. Bigbend, Hilmoe, Inavale, Nimbro, and Wendte soils formed in recent alluvium on flood plains along the White River and the Bad River. Kirley and Ree soils formed in old alluvium on high terraces. Hoven and Kolls soils formed in alluvium in basins on uplands. Witten soils formed on foot slopes

in local alluvium that was washed from the adjacent uplands.

Relief

Relief influences soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the more sloping soils, such as Sansarc soils, much of the rainfall is lost through runoff. As a result of excessive runoff, a limited amount of moisture penetrates the surface and much of the soil material is lost through erosion. These soils have a thin surface layer and a low content of organic matter. Runoff is slower on Kirley, Promise, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than Sansarc soils. Also, they have thicker horizons in which organic matter accumulates.

Hoven and Kolls soils are in basins where water ponds. These soils have the colors characteristic of poorly drained soils. Witten soils are on foot slopes that receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter accumulates are thicker than those in the slightly higher, adjacent Promise and Millboro soils. In low areas along drainageways, the fluctuating water table results in the concentration of salts in Herdcamp soils.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. Generally, the degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable for the longest time. Examples are Promise and Kirley soils, which have developed distinct horizons. The youngest soils are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Okaton and Sansarc soils are examples of young soils that are subject to natural erosion. Bigbend and Nimbro soils are examples of young alluvial soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. Geomorphic component that forms the steepest inclined surface and principal element of many hill slopes. Back slopes are commonly steep and linear and descend to a foot slope. Back slopes are erosional forms produced mainly by mass wasting and running water.

Basin. A depressed area with no surface outlet. Examples are closed depressions in a residual upland plain.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and

proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are:

Very deep	more than 60 inches
Deep	40 to 60 inches
Moderately deep	20 to 40 inches
Shallow	less than 20 inches

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant

periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition

between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and are less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Interfluve. The relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. Any elevated area between two drainageways that sheds water to them.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or

tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landform. Any physical, recognizable form or feature of the earth's surface having a characteristic shape and produced by natural causes.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pasture, tame. Grazingland that has been planted to primarily introduced or domesticated native forage species and that receives periodic renovation or cultural treatment, such as tillage, fertilization, mowing, weed control, or irrigation.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between

the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	below 3.4
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shoulder slope. The uppermost inclined surface at the top of a hillslope; a transition zone from the back slope to a summit of an upland. It is dominantly convex in profile and erosional in origin.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner,

and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes in this survey are as follows:

Level	0 to 1 percent
Nearly level	0 to 2 or 3 percent
Very gently sloping or gently undulating	1 to 3 percent
Gently sloping or undulating	2 or 3 to 6 percent
Moderately sloping or gently rolling	6 to 9 percent
Strongly sloping	9 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 40 percent
Very steep	more than 40 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. The top or highest level of an upland feature. A high interfluve area that has gentler slopes and that is flanked by the steeper hill slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It

includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Transitional layer. A layer of soil that grades to the next layer or includes parts of adjacent layers, commonly between the surface layer and the subsoil or the underlying layer.

Underlying layer. The C or Cr horizon or R layer; that part of the soil below the subsoil, commonly the parent material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1948-94 at Murdo, South Dakota)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	30.3	7.5	18.9	62	-23	6	0.34	0.11	0.58	1	4.3
February----	36.1	12.3	24.2	68	-19	18	.51	.15	.91	1	5.0
March-------	45.3	21.2	33.2	78	-10	63	1.28	.44	1.98	3	7.9
April-------	60.7	33.5	47.1	90	13	245	2.09	.80	3.33	4	3.5
May---------	71.7	44.8	58.2	93	22	550	2.80	1.63	3.85	5	.2
June--------	81.4	54.6	68.0	101	39	826	3.44	1.75	4.91	6	.0
July--------	89.2	60.3	74.8	107	46	1,067	2.33	1.12	3.38	5	.0
August------	88.0	58.6	73.3	106	43	1,025	1.85	.88	2.69	4	.0
September---	77.8	48.0	62.9	102	28	673	1.14	.41	1.90	2	.1
October-----	64.8	36.9	50.9	92	15	348	1.26	.49	2.16	2	1.0
November----	46.5	22.9	34.7	76	-4	68	.58	.18	1.05	1	3.9
December----	34.4	12.0	23.2	65	-19	9	.48	.16	.81	1	5.2
Yearly:											
Average---	60.5	34.4	47.5	---	---	---	---	---	---	---	---
Extreme---	112	-31	---	108	-25	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,898	18.11	14.25	21.36	35	31.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-87 at Murdo, South Dakota)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 3	May 14	May 23
2 years in 10 later than--	Apr. 28	May 8	May 18
5 years in 10 later than--	Apr. 16	Apr. 28	May 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 7	Sept. 26	Sept. 19
2 years in 10 earlier than--	Oct. 12	Oct. 1	Sept. 24
5 years in 10 earlier than--	Oct. 21	Oct. 10	Oct. 3

TABLE 3.--GROWING SEASON

(Recorded in the period 1956-82 at Murdo, South Dakota)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	162	143	124
8 years in 10	171	150	133
5 years in 10	187	164	148
2 years in 10	203	179	164
1 year in 10	212	186	172

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Albaton silty clay, depressional	597	0.1
Bb	Bigbend silt loam	3,227	0.5
Bf	Bigbend silt loam, flooded	1,190	0.2
Bg	Bigbend silty clay loam	637	0.1
Bh	Bigbend very fine sandy loam	815	0.1
Bi	Bigbend-Inavale complex	562	0.1
Bu	Bullcreek clay, 0 to 6 percent slopes	13,331	2.1
Bx	Bullcreek-Slickspots complex	2,969	0.5
CpA	Capa silt loam, 0 to 6 percent slopes	2,357	0.4
Hb	Herdcamp-Bullcreek complex	5,140	0.8
Hg	Hilmoe silt loam, overwash	200	*
Hm	Hilmoe silty clay	1,630	0.3
Hn	Hilmoe-Inavale complex	262	*
Ho	Hoven silt loam	283	*
In	Inavale loamy fine sand	735	0.1
KeA	Kirley clay loam, 0 to 2 percent slopes	7,483	1.2
KeB	Kirley clay loam, 2 to 6 percent slopes	46,341	7.5
KeC	Kirley clay loam, 6 to 9 percent slopes	7,866	1.3
KeD	Kirley clay loam, 9 to 15 percent slopes	5,016	0.8
KmB	Kirley-Mosher complex, 0 to 6 percent slopes	6,122	1.0
KnB	Kirley-Vivian complex, 2 to 6 percent slopes	652	0.1
KnC	Kirley-Vivian complex, 6 to 9 percent slopes	695	0.1
KnD	Kirley-Vivian complex, 9 to 25 percent slopes	6,627	1.1
Ko	Kolls silty clay	4,294	0.7
Kp	Kolls silty clay, ponded	1,075	0.2
LaB	Lakoma silty clay, 3 to 6 percent slopes	14,803	2.4
LaC	Lakoma silty clay, 6 to 9 percent slopes	23,250	3.7
LaD	Lakoma silty clay, 6 to 15 percent slopes	107,605	17.3
LkC	Lakoma-Kirley complex, 4 to 9 percent slopes	3,827	0.6
LvE	Lakoma-Vivian complex, 9 to 25 percent slopes	3,305	0.5
MlA	Millboro silty clay loam, 0 to 3 percent slopes	4,182	0.7
MlB	Millboro silty clay loam, 3 to 6 percent slopes	7,488	1.2
MlC	Millboro silty clay loam, 6 to 9 percent slopes	674	0.1
Mo	Mosher silt loam	4,810	0.8
Mp	Mosher-Capa silt loams	1,441	0.2
Nb	Nimbro silty clay loam	3,381	0.5
Nc	Nimbro silty clay loam, channeled	4,035	0.6
OaF	Okaton silty clay, 25 to 60 percent slopes	2,884	0.5
ObE	Okaton-Lakoma silty clays, 15 to 40 percent slopes	76,265	12.3
OkE	Okaton-Wendte-Bullcreek complex, 0 to 45 percent slopes	21,552	3.5
OlB	Opal clay loam, 3 to 6 percent slopes	5,452	0.9
OlC	Opal clay loam, 6 to 9 percent slopes	5,200	0.8
OlD	Opal clay loam, 6 to 15 percent slopes	3,361	0.5
OpA	Opal clay, 0 to 3 percent slopes	670	0.1
OpB	Opal clay, 3 to 6 percent slopes	20,901	3.4
OpC	Opal clay, 6 to 9 percent slopes	23,694	3.8
OpD	Opal clay, 6 to 15 percent slopes	40,218	6.5
Ot	Orthents, gravelly	167	*
PrA	Promise clay, 0 to 3 percent slopes	29,200	4.7
PrB	Promise clay, 3 to 6 percent slopes	31,707	5.1
PrC	Promise clay, 6 to 9 percent slopes	2,902	0.5
PsA	Promise-Bullcreek clays	2,532	0.4
PtA	Promise-Bullcreek-Kolls complex	322	0.1
Pu	Promise-Capa complex	1,864	0.3
ReA	Ree loam, 0 to 2 percent slopes	757	0.1
ReB	Ree loam, 2 to 6 percent slopes	2,349	0.4
ReC	Ree loam, 6 to 9 percent slopes	964	0.2
SaE	Sansarc clay, 15 to 40 percent slopes	15,830	2.5
SoE	Sansarc-Opal clays, 9 to 40 percent slopes	16,725	2.7
SrE	Sansarc-Rock outcrop complex, 9 to 60 percent slopes	1,561	0.3
SvE	Sansarc-Vivian complex, 9 to 40 percent slopes	3,276	0.5

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Wc	Wendte silty clay	1,844	0.3
Wd	Wendte silty clay, channeled	2,055	0.3
Wt	Witten silty clay	3,656	0.6
	Water	4,919	0.8
	Total	621,734	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
Bb	Bigbend silt loam (where irrigated)
Bg	Bigbend silty clay loam (where irrigated)
Bh	Bigbend very fine sandy loam (where irrigated)
Hg	Hilmoe silt loam, overwash (where irrigated)
Hm	Hilmoe silty clay (where irrigated)
KeA	Kirley clay loam, 0 to 2 percent slopes (where irrigated)
KeB	Kirley clay loam, 2 to 6 percent slopes (where irrigated)
MlA	Millboro silty clay loam, 0 to 3 percent slopes (where irrigated)
MlB	Millboro silty clay loam, 3 to 6 percent slopes (where irrigated)
Nb	Nimbro silty clay loam (where irrigated)
ReA	Ree loam, 0 to 2 percent slopes (where irrigated)
ReB	Ree loam, 2 to 6 percent slopes (where irrigated)
Wt	Witten silty clay (where irrigated)

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Wheat, winter	Grain sorghum	Oats	Wheat, spring	Alfalfa-hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM*
Ab---------- Albaton	---	---	---	---	---	---
Bb---------- Bigbend	35	35	49	20	1.9	3.2
Bf---------- Bigbend	---	---	---	---	---	---
Bg---------- Bigbend	35	35	49	20	1.9	3.2
Bh---------- Bigbend	34	35	49	---	1.9	---
Bi---------- Bigbend-Inavale	29	33	---	---	1.9	---
Bu---------- Bullcreek	---	---	---	---	---	---
Bx**---------- Bullcreek-Slickspots	---	---	---	---	---	---
CpA---------- Capa	---	---	---	---	---	---
Hb---------- Herdcamp-Bullcreek	---	---	---	---	---	---
Hg---------- Hilmoe	35	35	45	20	1.9	2.5
Hm---------- Hilmoe	32	32	40	20	1.8	2.4
Hn---------- Hilmoe-Inavale	28	30	---	2.0	1.6	2.0
Ho---------- Hoven	---	---	---	---	---	---
In---------- Inavale	23	30	---	---	1.8	---
KeA---------- Kirley	34	41	44	26	1.8	3.0
KeB---------- Kirley	33	39	41	25	1.7	2.8
KeC---------- Kirley	30	33	37	21	1.4	2.4
KeD---------- Kirley	---	29	---	---	1.2	2.0

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat, winter	Grain sorghum	Oats	Wheat, spring	Alfalfa-hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM*
KmB---------- Kirley-Mosher	26	33	33	18	1.5	2.3
KnB---------- Kirley-Vivian	26	29	33	18	1.5	2.5
KnC---------- Kirley-Vivian	23	27	31	16	1.3	2.3
KnD---------- Kirley-Vivian	---	---	---	---	---	---
Ko, Kp---------- Kolls	---	---	---	---	---	---
LaB---------- Lakoma	25	31	32	18	1.1	2.2
LaC---------- Lakoma	21	24	27	15	0.9	2.0
LaD---------- Lakoma	---	---	---	---	---	---
LkC---------- Lakoma-Kirley	25	28	31	16	1.0	2.1
LvE---------- Lakoma-Vivian	---	---	---	---	---	---
MlA---------- Millboro	37	48	48	26	2.0	3.3
MlB---------- Millboro	35	46	46	25	1.9	3.2
MlC---------- Millboro	30	39	39	21	1.3	2.7
Mo---------- Mosher	21	22	28	13	1.1	1.8
Mp---------- Mosher-Capa	---	---	---	---	---	---
Nb---------- Nimbro	32	40	48	26	2.8	3.3
Nc---------- Nimbro	---	---	---	---	---	---
OaF---------- Okaton	---	---	---	---	---	---
ObE---------- Okaton-Lakoma	---	---	---	---	---	---
OkE---------- Okaton-Wendte-Bullcreek	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat, winter	Grain sorghum	Oats	Wheat, spring	Alfalfa-hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM*
OlB---------- Opal	31	33	38	21	1.4	2.3
OlC---------- Opal	26	24	28	17	1.3	2.1
OlD---------- Opal	---	---	---	---	---	---
OpA---------- Opal	35	38	44	22	1.4	2.3
OpB---------- Opal	31	33	41	21	1.4	---
OpC---------- Opal	26	24	33	17	1.3	---
OpD---------- Opal	---	---	---	---	---	---
Ot---------- Orthents	---	---	---	---	---	---
PrA---------- Promise	36	44	45	24	1.5	2.4
PrB---------- Promise	34	42	42	23	1.5	2.4
PrC---------- Promise	29	33	32	21	1.3	2.2
PsA---------- Promise-Bullcreek	---	---	---	---	---	---
PtA---------- Promise-Bullcreek-Kolls	28	34	33	16	1.0	1.8
Pu---------- Promise-Capa	---	---	---	---	---	---
ReA---------- Ree	35	42	47	26	1.8	3.0
ReB---------- Ree	33	39	45	25	1.7	2.8
ReC---------- Ree	30	33	37	21	1.4	2.4
SaE---------- Sansarc	---	---	---	---	---	---
SoE---------- Sansarc-Opal	---	---	---	---	---	---
SrE**---------- Sansarc-Rock outcrop	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat, winter	Grain sorghum	Oats	Wheat, spring	Alfalfa-hay	Cool-season grass
	Bu	Bu	Bu	Bu	Tons	AUM*
SvE---------- Sansarc-Vivian	---	---	---	---	---	---
Wc---------- Wendte	32	38	50	---	1.8	2.5
Wd---------- Wendte	---	---	---	---	---	---
Wt---------- Witten	40	50	55	28	1.9	3.4

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND CHARACTERISTIC VEGETATION AND PRODUCTIVITY

Range site, soil name, and map symbols	Potential natural plant community		Potential annual production for kind of growing season		
	Common plant name	Composition	Favorable	Average	Unfavorable
		Pct	Lb/acre	Lb/acre	Lb/acre
Clayey	Western wheatgrass	45	2,500	2,100	1,500
Kirley: KeA, KeB, KeC, KeD, KmB, KnB, KnC, KnD, LkC	Green needlegrass	25			
	Blue grama	10			
	Sideoats grama	5			
Millboro: MlA, MlB, MlC	Buffalograss	5			
Opal: OlB, OlC, OlD, OpA, OpB, OpC, OpD, SoE	Sedges	5			
	Climax forbs	5			
Promise: PrA, PrB, PrC, PsA, PtA, Pu					
Clayey Overflow	Western wheatgrass	55	3,600	3,000	2,100
Albaton: Ab	Green needlegrass	20			
Hilmoe: Hm, Hn	Blue grama	5			
Wendte: OkE, Wc, Wd	Buffalograss	5			
Witten: Wt	Trees	5			
	Climax shrubs	5			
	Climax forbs	5			
Claypan	Western wheatgrass	40	1,900	1,600	1,100
Mosher: KmB, Mo, Mp	Green needlegrass	20			
	Buffalograss	10			
	Blue grama	10			
	Sedges	10			
	Needleandthread	5			
	Climax shrubs	5			
Closed Depression	Western wheatgrass	85	3,000	2,800	1,900
Hoven: Ho	Sedges	10			
Kolls: Ko, PtA	Climax forbs	5			
Dense Clay	Western wheatgrass	70	2,000	1,500	900
Bullcreek: Bu, Bx, Hb, OkE, PsA, PtA	Green needlegrass	20			
	Climax forbs	5			
	Climax shrubs	5			
Loamy Overflow	Big bluestem	40	5,300	4,400	3,100
Bigbend: Bf	Western wheatgrass	15			
Hilmoe: Hg	Switchgrass	10			
Nimbro: Nc	Indiangrass	5			
	Green needlegrass	5			
	Bluegrasses	5			
	Little bluestem	5			
	Climax shrubs	5			
	Climax forbs	5			
	Trees	5			
Loamy Terrace	Western wheatgrass	30	3,300	2,700	1,900
Bigbend: Bb, Bg, Bh, Bi	Green needlegrass	30			
Nimbro: Nb	Needleandthread	10			
	Little bluestem	5			
	Big bluestem	5			
	Prairie sandreed	5			
	Blue grama	5			
	Climax forbs	5			
	Climax shrubs	5			

TABLE 7.--RANGELAND CHARACTERISTIC VEGETATION AND PRODUCTIVITY--Continued

Range site, soil name, and map symbols	Potential natural plant community		Potential annual production for kind of growing season		
	Common plant name	Composition	Favorable	Average	Unfavorable
		Pct	Lb/acre	Lb/acre	Lb/acre
Sands	Prairie sandreed	25	2,900	2,400	1,700
Inavale: Bi, Hn, In	Little bluestem	20			
	Big bluestem	15			
	Sand bluestem	10			
	Switchgrass	5			
	Indiangrass	5			
	Needleandthread	5			
	Blue grama	5			
	Climax forbs	5			
	Climax shrubs	5			
Shallow	Little bluestem	40	2,000	1,700	1,200
Okaton: OaF, ObE, OkE	Sideoats grama	10			
	Blue grama	10			
	Plains muhly	5			
	Big bluestem	5			
	Green needlegrass	5			
	Western wheatgrass	5			
	Needleandthread	5			
	Sedges	5			
	Climax forbs	5			
	Climax shrubs	5			
Shallow Clay	Little bluestem	30	2,000	1,700	1,200
Sansarc: SaE, SoE, SrE, SvE	Western wheatgrass	20			
	Green needlegrass	15			
	Sideoats grama	10			
	Big bluestem	5			
	Blue grama	5			
	Sedges	5			
	Climax forbs	5			
	Climax shrubs	5			
Shallow Marsh	Smartweed	35	3,000	2,800	2,200
Kolls: Kp	Common spikesedge	35			
	American bulrush	10			
	Curled dock	10			
	Western wheatgrass	5			
	Prairie cordgrass	5			
Silty	Western wheatgrass	40	2,700	2,300	1,600
Ree: ReA, ReB, ReC	Green needlegrass	15			
	Needleandthread	10			
	Blue grama	10			
	Big bluestem	5			
	Sideoats grama	5			
	Porcupinegrass	5			
	Climax forbs	5			
	Climax shrubs	5			
Thin Claypan	Western wheatgrass	25	1,300	1,100	700
Capa: CpA, Mp, Pu	Blue grama	25			
	Needleandthread	15			
	Buffalograss	15			
	Climax forbs	10			
	Sedges	5			
	Inland saltgrass	5			

TABLE 7.--RANGELAND CHARACTERISTIC VEGETATION AND PRODUCTIVITY--Continued

Range site, soil name, and map symbols	Potential natural plant community		Potential annual production for kind of growing season		
	Common plant name	Composition	Favorable	Average	Unfavorable
		Pct	Lb/acre	Lb/acre	Lb/acre
Thin Upland	Little bluestem	20	2,100	1,800	1,200
Lakoma: LaB, LaC, LaD, LkC, LvE, ObE	Big bluestem	20			
	Sideoats grama	10			
Vivian: KnB, KnC, KnD, LvE, SvE	Blue grama	5			
	Prairie sandreed	5			
	Porcupinegrass	5			
	Green needlegrass	5			
	Needleandthread	5			
	Western wheatgrass	5			
	Needleleaf sedge	5			
	Threadleaf sedge	5			
	Climax forbs	5			
	Climax shrubs	5			
Wetland	Prairie cordgrass	70	6,300	5,800	4,700
Herdcamp: Hb	Switchgrass	5			
	Canada wildrye	5			
	Sedges	5			
	Rushes	5			
	Climax forbs	5			
	Climax shrubs	5			

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(In Jones County, none of the soils are assigned to windbreak suitability groups 2, 5, and 6. The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on the soils in that group)

Windbreak suitability group, soil name, and map symbols	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Group 1---------- Bigbend: Bb, Bf, Bg, Bh, Bi Nimbro: Nb, Nc	American plum, Amur honeysuckle, common lilac, European cotoneaster, golden currant, Hansen hedgerose, juneberry, late lilac, Mongolian cherry, Nanking cherry, Peking cotoneaster, redosier dogwood, Russian almond, silver buffaloberry, skunkbush sumac, western sandcherry.	Amur maple, Arnold hawthorn, common chokecherry, Manchurian apricot, Manchurian crabapple, Siberian apricot, Siberian crabapple, Siberian peashrub, Ussurian pear.	Black Hills spruce, blue spruce, boxelder, bur oak, eastern redcedar, European birdcherry, green ash, hackberry, ponderosa pine, Rocky Mountain juniper, Russian-olive, Scotch pine, white poplar.	Golden willow, honeylocust, Siberian elm, white willow.	Carolina poplar, eastern cottonwood, northwest poplar, plains cottonwood, robusta poplar.
Group 3---------- Kirley: KeA, KeB, KeC, KeD, KmB, KnB, KnC, KnD, LkC Ree: ReA, ReB, ReC	American plum, Amur honeysuckle, common lilac, European cotoneaster, golden currant, Hansen hedgerose, juneberry, late lilac, Mongolian cherry, Nanking cherry, Peking cotoneaster, redosier dogwood, silver buffaloberry, skunkbush sumac, western sandcherry.	Amur maple, Arnold hawthorn, common chokecherry, eastern redcedar, Manchurian apricot, Manchurian crabapple, Rocky Mountain juniper, Siberian apricot, Siberian crabapple, Siberian peashrub, Ussurian pear.	Black Hills spruce, blue spruce, boxelder, bur oak, European birdcherry, green ash, hackberry, honeylocust, ponderosa pine, Russian-olive, Scotch pine, white poplar.	Siberian elm------	---
Group 4---------- Hilmoe: Hg, Hm, Hn Millboro: MlA, MlB, MlC Opal: OlB, OlC, OlD, OpA, OpB, OpC, OpD Promise: PrA, PrB, PrC, PsA, PtA, Pu Wendte: OkE, Wc, Wd Witten: Wt	American plum, common lilac, European cotoneaster, golden currant, Nanking cherry, Peking cotoneaster, Russian almond, Siberian peashrub, silver buffaloberry, skunkbush sumac.	Arnold hawthorn, common chokecherry, eastern redcedar, green ash, hackberry, Manchurian apricot, Manchurian crabapple, ponderosa pine, Russian-olive, Siberian apricot, Siberian crabapple, Ussurian pear, white poplar.	Honeylocust, Siberian elm.	---	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Windbreak suitability group, soil name, and map symbols	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Group 7---------- Inavale: Bi, Hn, In	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine----	---	---
Group 8---------- Lakoma: LaB, LaC, LkC Vivian: KnB, KnC	Common lilac, Russian almond, Siberian peashrub, silver buffaloberry.	Eastern redcedar, green ash, ponderosa pine, Rocky Mountain juniper, Russian-olive, Ussurian pear, white poplar.	Siberian elm------	---	---
Group 9---------- Mosher: KmB, Mo, Mp	Common lilac, eastern redcedar, Rocky Mountain juniper, Russian almond, Siberian peashrub, silver buffaloberry, Ussurian pear.	Green ash, ponderosa pine, Russian-olive, Siberian elm.	---	---	---
Group 10---------- Albaton: Ab Bullcreek: Bu, Bx, Hb, OkE, PsA, PtA Capa: CpA, Mp, Pu Herdcamp: Hb Hoven: Ho Kolls: Ko, Kp, PtA Lakoma: LaD, LvE, ObE Okaton: OaF, ObE, OkE Opal: SoE Orthents: Ot Sansarc: SaE, SoE, SrE, SvE Slickspots: Bx Vivian: KnD, LvE, SvE	None----------	None----------	None----------	None----------	None.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ab Albaton	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.
Bb Bigbend	Severe: flooding.	Slight	Slight	Slight.
Bf Bigbend	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Bg, Bh Bigbend	Severe: flooding.	Slight	Slight	Slight.
Bi*: Bigbend	Severe: flooding.	Slight	Slight	Slight.
Inavale	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Bu Bullcreek	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Severe: erodes easily.
Bx*: Bullcreek	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
Slickspots	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Slight.
CpA Capa	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Hb*: Herdcamp	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.
Bullcreek	Severe: flooding.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
Hg Hilmoe	Severe: flooding.	Slight	Slight	Slight.
Hm Hilmoe	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Hn*: Hilmoe	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hn*:				
Inavale	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Ho Hoven	Severe: ponding, percs slowly, excess sodium.	Severe: ponding, excess sodium, percs slowly.	Severe: ponding, percs slowly, excess sodium.	Severe: ponding.
In Inavale	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
KeA Kirley	Slight	Slight	Slight	Slight.
KeB Kirley	Slight	Slight	Moderate: slope.	Slight.
KeC Kirley	Slight	Slight	Severe: slope.	Slight.
KeD Kirley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
KmB*:				
Kirley	Slight	Slight	Moderate: slope.	Slight.
Mosher	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
KnB*:				
Kirley	Slight	Slight	Moderate: slope.	Slight.
Vivian	Slight	Slight	Severe: small stones.	Slight.
KnC*:				
Kirley	Slight	Slight	Severe: slope.	Slight.
Vivian	Slight	Slight	Severe: slope, small stones.	Slight.
KnD*:				
Kirley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Vivian	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
Ko Kolls	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Kp Kolls	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.
LaB Lakoma	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope, thin layer.	Moderate: too clayey.
LaC Lakoma	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
LaD* Lakoma	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Severe: erodes easily.
LkC*: Lakoma	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Kirley	Slight	Slight	Moderate: slope.	Slight.
LvE*: Lakoma	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Severe: erodes easily.
Vivian	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
MlA Millboro	Slight	Slight	Slight	Severe: erodes easily.
MlB Millboro	Slight	Slight	Moderate: slope.	Severe: erodes easily.
MlC Millboro	Slight	Slight	Severe: slope.	Severe: erodes easily.
Mo Mosher	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Mp*: Mosher	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Capa	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Nb Nimbro	Severe: flooding.	Slight	Slight	Slight.
Nc Nimbro	Severe: flooding.	Slight	Moderate: flooding	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
OaF---------- Okaton	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
ObE*:				
Okaton----------	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
Lakoma----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
OkE*:				
Okaton----------	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
Wendte----------	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.
Bullcreek----------	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Severe: erodes easily.
OlB---------- Opal	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
OlC---------- Opal	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight.
OlD---------- Opal	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
OpA---------- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
OpB---------- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: erodes easily.
OpC---------- Opal	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
OpD---------- Opal	Moderate: slope, percs slowly.	Moderate: slope, too clayey.	Severe: slope.	Severe: erodes easily.
Ot*---------- Orthents	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PrA--- Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
PrB--- Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Severe: erodes easily.
PrC--- Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
PsA*: Promise---	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
Bullcreek---	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
PtA*: Promise---	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
Bullcreek---	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
Kolls---	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.
Pu*: Promise---	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
Capa---	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
ReA--- Ree	Slight---	Slight---	Slight---	Slight.
ReB--- Ree	Slight---	Slight---	Moderate: slope.	Slight.
ReC--- Ree	Slight---	Slight---	Severe: slope.	Slight.
SaE--- Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SoE*:				
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Opal	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
SrE*:				
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
SvE*:				
Sansarc	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Vivian	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
Wc	Severe:	Moderate:	Moderate:	Moderate:
Wendte	flooding.	too clayey.	too clayey.	too clayey.
Wd	Severe:	Moderate:	Moderate:	Moderate:
Wendte	flooding.	too clayey.	too clayey, flooding.	too clayey.
Wt	Moderate:	Moderate:	Moderate:	Moderate:
Witten	too clayey.	too clayey.	too clayey.	too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor")

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
Ab---------- Albaton	Poor	Poor	Good	Very poor.	Fair	Poor	Fair	Fair	Fair.
Bb---------- Bigbend	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
Bf---------- Bigbend	Poor	Good	Good	Good	Good	Poor	Poor	Very poor.	Very poor.
Bg, Bh---------- Bigbend	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
Bi*: Bigbend----------	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
Inavale----------	Poor	Fair	Fair	Poor	Fair	Poor	Fair	Very poor.	Very poor.
Bu---------- Bullcreek	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Bx*: Bullcreek---------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Slickspots--------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CpA---------- Capa	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hb*: Herdcamp----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Fair.
Bullcreek---------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hg---------- Hilmoe	Good	Fair	Good	Good	Fair	Very poor.	Fair	Very poor.	Very poor.
Hm---------- Hilmoe	Fair	Fair	Good	Fair	Fair	Very poor.	Fair	Very poor.	Very poor.
Hn*: Hilmoe----------	Fair	Fair	Good	Fair	Fair	Very poor.	Fair	Very poor.	Very poor.
Inavale----------	Poor	Fair	Fair	Poor	Fair	Poor	Fair	Very poor.	Very poor.
Ho---------- Hoven	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
In---- Inavale	Poor	Fair	Fair	Poor	Fair	Poor	Fair	Very poor.	Very poor.
KeA, KeB---- Kirley	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
KeC---- Kirley	Fair	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
KeD---- Kirley	Poor	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
KmB*:									
Kirley----	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Mosher----	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
KnB*:									
Kirley----	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Vivian----	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.
KnC*:									
Kirley----	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Vivian----	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.
KnD*:									
Kirley----	Poor	Good	Good	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
Vivian----	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Ko---- Kolls	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good.
Kp---- Kolls	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good.
LaB---- Lakoma	Fair	Fair	Fair	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
LaC---- Lakoma	Poor	Fair	Fair	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
LaD*---- Lakoma	Very poor.	Fair	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
LkC*:									
Lakoma----	Poor	Fair	Fair	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
LkC*:									
Kirley	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
LvE*:									
Lakoma	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Vivian	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
MlA Millboro	Good	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
MlB Millboro	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
MlC Millboro	Poor	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Mo Mosher	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Mp*:									
Mosher	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Capa	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Nb Nimbro	Good	Good	Good	Good	Fair	Very poor.	Fair	Very poor.	Very poor.
Nc Nimbro	Very poor.	Good	Good	Good	Fair	Very poor.	Fair	Very poor.	Very poor.
OaF Okaton	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
ObE*:									
Okaton	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Lakoma	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
OkE*:									
Okaton	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Wendte	Very poor.	Very poor.	Good	Fair	Fair	Poor	Good	Very poor.	Very poor.
Bullcreek	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
OlB Opal	Fair	Fair	Good	Good	Fair	Very poor.	Poor	Very poor.	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
OlC--Opal	Poor	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
OlD--Opal	Very poor.	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
OpA, OpB--Opal	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
OpC--Opal	Poor	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
OpD*--Opal	Very poor.	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Ot*--Orthents	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PrA, PrB--Promise	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
PrC--Promise	Poor	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
PsA*:									
Promise	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Bullcreek	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PtA*:									
Promise	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Bullcreek	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Kolls	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Fair.
Pu*:									
Promise	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Capa	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ReA, ReB--Rea	Good	Good	Good	Good	Fair	Very poor.	Fair	Very poor.	Very poor.
ReC--Rea	Fair	Good	Good	Fair	Fair	Very poor.	Fair	Very poor.	Very poor.
SaE--Sansarc	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
SoE*:									
Sansarc	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Opal	Very poor.	Very poor.	Good	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
SrE*:									
Sansarc	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Rock outcrop	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SvE*:									
Sansarc	Very poor.	Very poor.	Fair	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Vivian	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Wc Wendte	Fair	Fair	Good	Fair	Fair	Very poor.	Good	Very poor.	Very poor.
Wd Wendte	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Good	Very poor.	Very poor.
Wt Witten	Fair	Fair	Good	Fair	Fair	Very poor.	Good	Very poor.	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ab Albaton	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.
Bb Bigbend	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Bf Bigbend	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Bg, Bh Bigbend	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Bi*: Bigbend	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Bu Bullcreek	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Bx*: Bullcreek	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Slickspots	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
CpA Capa	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hb*: Herdcamp	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Bullcreek	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.
Hg, Hm Hilmoe	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, low strength, flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hn*:					
Hilmoe	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Ho Hoven	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.
In Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
KeA, KeB, KeC Kirley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
KeD Kirley	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
KmB*:					
Kirley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Mosher	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
KnB*, KnC*:					
Kirley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Vivian	Slight	Slight	Slight	Moderate: slope.	Slight.
KnD*:					
Kirley	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Vivian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ko Kolls	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Kp Kolls	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
LaB, LaC---------- Lakoma	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
LaD---------- Lakoma	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
LkC*:					
Lakoma----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Kirley----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
LvE*:					
Lakoma----------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Vivian----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MlA, MlB, MlC----- Millboro	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Mo---------- Mosher	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Mp*:					
Mosher----------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Capa----------	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Nb---------- Nimbro	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Nc---------- Nimbro	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
OaF---------- Okaton	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.
ObE*:					
Okaton----------	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
ObE*:					
Lakoma	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
OkE*:					
Okaton	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: slope.
Wendte	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.
Bullcreek	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
OlB, OlC Opal	Severe: cutbanks cave.	Severe: shrink-swell.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
OlD Opal	Severe: cutbanks cave.	Severe: shrink-swell.	Moderate: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
OpA, OpB, OpC Opal	Severe: cutbanks cave.	Severe: shrink-swell.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
OpD Opal	Severe: cutbanks cave.	Severe: shrink-swell.	Moderate: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Ot* Orthents	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
PrA, PrB, PrC Promise	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
PsA*:					
Promise	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Bullcreek	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
PtA*:					
Promise	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
PtA*:					
Bullcreek	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Kolls	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Pu*:					
Promise	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Capa	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ReA, Ree	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
ReB, ReC, Ree	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.
SaE, Sansarc	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
SoE*:					
Sansarc	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Opal	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
SrE*:					
Sansarc	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Rock outcrop	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
SvE*:					
Sansarc	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
SvE*: Vivian	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wc Wendte	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.
Wd Wendte	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.
Wt Witten	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab Albaton	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
Bb Bigbend	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey, too sandy.	Moderate: flooding.	Fair: too clayey.
Bf Bigbend	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Bg, Bh Bigbend	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey, too sandy.	Moderate: flooding.	Fair: too clayey.
Bi*: Bigbend	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey, too sandy.	Moderate: flooding.	Fair: too clayey.
Inavale	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Bu Bullcreek	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Bx*: Bullcreek	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Slickspots	Severe: percs slowly.	Moderate: depth to rock.	Severe: depth to rock, excess salt.	Moderate: depth to rock.	Poor: excess salt.
CpA Capa	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Hb*: Herdcamp	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Bullcreek	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Hg, Hm---------- Hilmoe	Severe: percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Hn*: Hilmoe----------	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Inavale----------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Ho---------- Hoven	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey, excess sodium.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
In---------- Inavale	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
KeA---------- Kirley	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
KeB---------- Kirley	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
KeC---------- Kirley	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
KeD---------- Kirley	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
KmB*: Kirley----------	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Mosher----------	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight----------	Poor: too clayey, hard to pack, excess sodium.
KnB*: Kirley----------	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Vivian----------	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
KnC*:					
Kirley	Severe: percs slowly.	Severe: slope.	Severe: too clayey	Slight	Poor: too clayey, hard to pack.
Vivian	Moderate: depth to rock.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: small stones.
KnD*:					
Kirley	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Vivian	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Ko Kolls	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Kp Kolls	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
LaB Lakoma	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
LaC Lakoma	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
LaD Lakoma	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
LkC*:					
Lakoma	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
Kirley	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LvE*:					
Lakoma	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LvE*:					
Vivian	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
MlA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MlB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MlC	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Mo	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Mp*:					
Mosher	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Capa	Severe: wetness, percs slowly.	Slight	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Nb	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Nc	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
OaF	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
ObE*:					
Okaton	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
Lakoma	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OkE*:					
Okaton	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
Wendte	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
Bullcreek	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
OlB	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
OlC, OlD	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
OpA, OpB	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
OpC, OpD	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
Ot*	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
PrA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PrB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PrC	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PsA*:					
Promise	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Bullcreek	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PtA*:					
Promise	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PtA*:					
Bullcreek	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Kolls	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Pu*:					
Promise	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Capa	Severe: wetness, percs slowly.	Slight	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
ReA Ree	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
ReB Ree	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
ReC Ree	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SaE Sansarc	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
SoE*:					
Sansarc	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
Opal	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
SrE*:					
Sansarc	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
Rock outcrop	Severe: depth to rock, slope, seepage.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope, seepage.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SvE*:					
Sansarc	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope.	Poor: depth to rock, hard to pack, slope.
Vivian	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Wc	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Moderate: flooding, wetness.	Poor: too clayey, hard to pack.
Wd	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
Wt	Severe: wetness, percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab Albaton	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Bb Bigbend	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Bf Bigbend	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Bg, Bh Bigbend	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Bi*: Bigbend	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Inavale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Bu Bullcreek	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Bx*: Bullcreek	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Slickspots	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
CpA Capa	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Hb*: Herdcamp	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Bullcreek	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Hg, Hm Hilmoe	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hn*: Hilmoe	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hn*:				
Inavale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Ho	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
In	Good	Probable	Improbable: too sandy.	Poor: too sandy.
KeA, KeB, KeC, KeD	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KmB*:				
Kirley	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Mosher	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
KnB*, KnC*:				
Kirley	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Vivian	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
KnD*:				
Kirley	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Vivian	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Ko, Kp	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
LaB, LaC, LaD	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LkC*:				
Lakoma	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LkC*:				
Kirley	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LvE*:				
Lakoma	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Vivian	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
M1A, M1B, M1C Millboro	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Mo Mosher	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Mp*:				
Mosher	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Capa	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Nb, Nc Nimbro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
OaF Okaton	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
ObE*:				
Okaton	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Lakoma	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
OkE*:				
Okaton	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OkE*:				
Wendte	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Bullcreek	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
OlB, OlC, OlD, OpA, OpB, OpC, OpD, Opal	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ot*	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
PrA, PrB, PrC	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PsA*:				
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Bullcreek	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
PtA*:				
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Bullcreek	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Kolls	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Pu*:				
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Capa	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
ReA, ReB, ReC	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SaE---------- Sansarc	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
SoE*:				
Sansarc----------	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Opal----------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
SrE*:				
Sansarc----------	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Rock outcrop---------	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, area reclaim, slope.
SvE*:				
Sansarc----------	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Vivian----------	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wc, Wd---------- Wendte	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Wt---------- Witten	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ab---- Albaton	Slight----	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
Bb---- Bigbend	Moderate: seepage.	Severe: piping.	Deep to water	Favorable----	Erodes easily	Erodes easily.
Bf---- Bigbend	Moderate: seepage.	Severe: piping.	Deep to water	Flooding----	Erodes easily too sandy.	Erodes easily. slope.
Bg---- Bigbend	Moderate: seepage.	Severe: piping.	Deep to water	Favorable----	Erodes easily	Erodes easily.
Bh---- Bigbend	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
Bi*:						
Bigbend----	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
Inavale----	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Bu---- Bullcreek	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Bx*:						
Bullcreek----	Slight----	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Slickspots----	Moderate: depth to rock.	Severe: excess salt.	Deep to water	Excess salt----	Erodes easily, percs slowly.	Excess salt, erodes easily, percs slowly.
CpA---- Capa	Moderate: slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
Hb*:						
Herdcamp----	Slight----	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, droughty, slow intake.	Wetness, percs slowly.	Wetness, droughty.
Bullcreek----	Slight----	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Hg---- Hilmoe	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly---	Erodes easily	Erodes easily, percs slowly.
Hm---- Hilmoe	Moderate: seepage.	Severe: piping.	Deep to water	Slow intake, percs slowly.	Erodes easily	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hn*:						
Hilmoe	Moderate: seepage.	Severe: piping.	Deep to water	Slow intake, percs slowly, flooding.	Erodes easily	Erodes easily, percs slowly.
Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Ho Hoven	Slight	Severe: hard to pack, piping, excess sodium.	Ponding, percs slowly, excess salt.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, excess sodium, erodes easily.
In Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
KeA Kirley	Moderate: seepage.	Severe: hard to pack.	Deep to water	Percs slowly	Erodes easily	Erodes easily, percs slowly.
KeB, KeC Kirley	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily, percs slowly.
KeD Kirley	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Slope, erodes easily.	Slope, erodes easily, percs slowly.
KmB*:						
Kirley	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily, percs slowly.
Mosher	Moderate: seepage.	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Excess sodium, erodes easily.
KnB*, KnC*:						
Kirley	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily, percs slowly.
Vivian	Severe: seepage.	Moderate: thin layer.	Deep to water	Slope, droughty.	Favorable	Droughty.
KnD*:						
Kirley	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Slope, erodes easily.	Slope, erodes easily, percs slowly.
Vivian	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope	Slope, droughty.
Ko Kolls	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, droughty, slow intake.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Kp---------- Kolls	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, droughty, slow intake.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, droughty.
LaB, LaC---------- Lakoma	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily. droughty.
LaD*---------- Lakoma	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
LkC*:						
Lakoma----------	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, droughty.
Kirley----------	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily, percs slowly.
LvE*:						
Lakoma----------	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
Vivian----------	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope----------	Slope, droughty.
MlA---------- Millboro	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MlB, MlC---------- Millboro	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Mo---------- Mosher	Moderate: seepage.	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Excess sodium, erodes easily.
Mp*:						
Mosher----------	Moderate: seepage.	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Excess sodium, erodes easily.
Capa----------	Slight---------	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
Nb---------- Nimbro	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Favorable------	Favorable.
Nc---------- Nimbro	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Flooding-------	Favorable------	Favorable.
OaF---------- Okaton	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, slow intake, percs slowly.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.

See footnote at end of table.

TABLE 14 --WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ObE*:						
Okaton	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, slow intake, percs slowly.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Lakoma	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
OkE*:						
Okaton	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, slow intake, percs slowly.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Wendte	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Bullcreek	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
OlB, OlC Opal	Moderate: depth to rock, slope.	Slight	Deep to water	Slope, droughty.	Depth to rock, erodes easily.	Erodes easily, droughty.
OlD Opal	Severe: slope.	Slight	Deep to water	Slope, droughty.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
OpA Opal	Moderate: depth to rock.	Slight	Deep to water	Droughty, slow intake.	Depth to rock, erodes easily.	Erodes easily, droughty.
OpB, OpC Opal	Moderate: depth to rock, slope.	Slight	Deep to water	Slope, droughty, slow intake.	Depth to rock, erodes easily.	Erodes easily, droughty.
OpD* Opal	Severe: slope.	Slight	Deep to water	Slope, droughty, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Ot* Orthents	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
PrA Promise	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
PrB, PrC Promise	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
PsA*:						
Promise	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Bullcreek	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PtA*:						
Promise	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Bullcreek	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Kolls	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, droughty, slow intake.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, droughty.
Pu*:						
Promise	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Capa	Slight	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
ReA Ree	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
ReB, ReC Ree	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
SaE Sansarc	Severe: depth to rock, slope, seepage.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SoE*:						
Sansarc	Severe: depth to rock, slope, seepage.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Opal	Severe: slope.	Slight	Deep to water	Slope, droughty, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SrE*:						
Sansarc	Severe: depth to rock, slope, seepage.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Rock outcrop	Severe: seepage, depth to rock, slope.	Severe: hard to pack.	Deep to water	Slope, depth to rock, rooting depth.	Slope, depth to rock.	Slope, depth to rock, rooting depth.
SvE*:						
Sansarc	Severe: depth to rock, slope, seepage.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Vivian	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope	Slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Wc, Wd---------- Wendte	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Wt---------- Witten	Slight---------	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15 --ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Ab	0-60	Silty clay	CH, MH	A-7	0	100	100	95-100	95-100	70-90	40-60
Albaton											
Bb	0-8	Silt loam	ML, CL	A-4, A-6	0	100	100	95-100	70-95	25-40	2-15
Bigbend	8-60	Stratified very fine sandy loam to silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	55-95	20-35	NP-15
Bf	0-8	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	20-40	2-20
Bigbend	8-60	Stratified loamy very fine sand to silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	50-90	20-35	2-15
Bg	0-10	Silty clay loam	ML, CL	A-6, A-7	0	100	100	95-100	85-95	35-50	10-25
Bigbend	10-60	Stratified very fine sandy loam to silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	55-95	20-35	NP-15
Bh	0-8	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-95	50-65	20-35	2-10
Bigbend	8-60	Stratified very fine sandy loam to silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	55-95	20-35	NP-15
Bi*:											
Bigbend	0-8	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-95	50-65	20-35	2-10
	8-60	Stratified very fine sandy loam to silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	55-95	20-35	NP-15
Inavale	0-4	Loamy fine sand	SM, SP-SM, SC-SM	A-2, A-3	0	100	100	85-95	5-35	15-25	NP-5
	4-8	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
	8-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
Bu	0-3	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	28-60
Bullcreek	3-12	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	12-25	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	25-60	Clay	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60
Bx*:											
Bullcreek	0-3	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	28-60
	3-12	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	12-25	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	25-60	Clay	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60
Slickspots	0-40	Clay loam	CH, ML, MH, CL	A-6, A-7	0	100	100	90-100	70-100	35-55	10-30
	40-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15 --ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
CpA	0-1	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	7-20
Capa	1-15	Clay	CH, MH	A-7	0	100	100	95-100	90-100	60-85	25-50
	15-60	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	60-85	25-50
Hb*:											
Herdcamp	0-6	Silty clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-50
	6-60	Silty clay, clay, silty clay loam.	CH, MH	A-7	0	100	100	90-100	75-100	50-80	20-50
Bullcreek	0-3	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	28-60
	3-12	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	12-25	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	25-60	Clay	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60
Hg	0-8	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Hilmoe	8-38	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	40-65	20-40
	38-60	Stratified very fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	55-80	25-40	5-15
Hm	0-7	Silty clay	CL, CH	A-7	0	100	95-100	95-100	80-100	40-60	20-40
Hilmoe	7-30	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	40-65	20-40
	30-60	Stratified very fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	55-80	25-40	5-15
Hn*:											
Hilmoe	0-7	Silty clay	CL, CH	A-7	0	100	95-100	95-100	80-100	40-60	20-40
	7-30	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	40-65	20-40
	30-60	Stratified very fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	55-80	25-40	5-15
Inavale	0-4	Loamy fine sand	SM, SP-SM, SC-SM	A-2, A-3	0	100	100	85-95	5-35	15-25	NP-5
	4-8	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
	8-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
Ho	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
Hoven	4-8	Silty clay, clay, clay loam.	CH, MH, CL, ML	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	8-23	Silty clay, clay, clay loam.	CH, MH, CL, ML	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	23-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45

See footnote at end of table.

TABLE 15 --ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
In---------- Inavale	0-4	Loamy fine sand	SM, SP-SM, SC-SM	A-2, A-3	0	100	100	85-95	5-35	15-25	NP-5
	4-8	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
	8-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-85	5-30	15-25	NP-5
KeA, KeB, KeC, KeD---------- Kirley	0-6	Clay loam---------	CL	A-6, A-7	0	100	95-100	90-100	65-80	25-45	11-20
	6-18	Clay, clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	65-80	35-60	15-35
	18-25	Clay loam, clay, sandy clay.	CL, CH	A-6, A-7	0	100	90-100	85-100	60-80	35-60	15-35
	25-40	Clay loam, clay	CL, CH, MH, ML	A-6, A-7	0	100	90-100	85-100	55-85	35-55	10-30
	40-60	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	50-75	30-45	8-15
KmB*: Kirley----------	0-6	Clay loam---------	CL	A-6, A-7	0	100	95-100	90-100	65-80	25-45	11-20
	6-18	Clay, clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	65-80	35-60	15-35
	18-25	Clay loam, clay, sandy clay.	CL, CH	A-6, A-7	0	100	90-100	85-100	60-80	35-60	15-35
	25-40	Clay loam, clay	CL, CH, MH, ML	A-6, A-7	0	100	90-100	85-100	55-85	35-55	10-30
	40-60	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	50-75	30-45	8-15
Mosher----------	0-6	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	85-100	70-100	25-40	5-20
	6-25	Clay loam, silty clay, clay.	CL, ML, CH, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30
	25-60	Clay loam, silty clay, loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	10-35
KnB*, KnC*, KnD*: Kirley----------	0-6	Clay loam---------	CL	A-6, A-7	0	100	95-100	90-100	65-80	25-45	11-20
	6-18	Clay, clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	65-80	35-60	15-35
	18-25	Clay loam, clay, sandy clay.	CL, CH	A-6, A-7	0	100	90-100	85-100	60-80	35-60	15-35
	25-40	Clay loam, clay	CL, CH, MH, ML	A-6, A-7	0	100	90-100	85-100	55-85	35-55	10-30
	40-60	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	50-75	30-45	8-15
Vivian------	0-4	Gravelly loam----	CL, SC	A-4, A-6	0-5	80-100	50-75	45-60	35-55	30-40	8-18
	4-50	Very gravelly loam, extremely gravelly loam, very gravelly fine sandy loam.	GC, GP-GC	A-2, A-4, A-6	0-5	40-60	20-50	15-50	10-50	30-40	8-18
	50-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Ko, Kp---------- Kolls	0-12	Silty clay-------	CH, MH	A-7	0	100	100	95-100	85-100	50-90	25-50
	12-23	Clay----------	CH, MH	A-7	0	100	100	95-100	85-100	60-90	25-55
	23-60	Clay----------	CH, MH	A-7	0	100	100	95-100	85-100	60-90	25-55

See footnote at end of table.

TABLE 15 --ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
LaB, LaC, LaD-----	0-5	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
Lakoma	5-26	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	26-36	Silty clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
LkC*:											
Lakoma-----------	0-5	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-26	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	26-36	Silty clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Kirley-----------	0-6	Clay loam--------	CL	A-6, A-7	0	100	95-100	90-100	65-80	25-45	11-20
	6-18	Clay, clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	65-80	35-60	15-35
	18-25	Clay loam, clay, sandy clay.	CL, CH	A-6, A-7	0	100	90-100	85-100	60-80	35-60	15-35
	25-40	Clay loam, clay	CL, CH, MH, ML	A-6, A-7	0	100	90-100	85-100	55-85	35-55	10-30
	40-60	Loam, clay loam	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	50-75	30-45	8-15
LvE*:											
Lakoma-----------	0-5	Silty clay-------	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-26	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	26-36	Silty clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Vivian-----------	0-4	Gravelly loam----	CL, SC	A-4, A-6	0-5	80-100	50-75	45-60	35-55	30-40	8-18
	4-50	Very gravelly loam, extremely gravelly loam, very gravelly fine sandy loam.	GC, GP-GC	A-2, A-4, A-6	0-5	40-60	20-50	15-50	10-50	30-40	8-18
	50-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
MlA, MlB, MlC-----	0-9	Silty clay loam	CH, MH, ML, CL	A-7	0	100	100	90-100	75-100	45-70	15-40
Millboro	9-18	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-50
	18-60	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
Mo----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	70-100	25-40	5-20
Mosher	6-25	Clay loam, silty clay, clay.	CL, ML, CH, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30
	25-60	Clay loam, silty clay, clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	10-35
Mp*:											
Mosher-----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	70-100	25-40	5-20
	6-25	Clay loam, silty clay, clay.	CL, ML, CH, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30
	25-60	Clay loam, silty clay, loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	10-35
Capa----------	0-1	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	7-20
	1-15	Clay----------	CH, MH	A-7	0	100	100	95-100	90-100	60-85	25-50
	15-60	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	60-85	25-50
Nb----------	0-7	Silty clay loam	ML, CL	A-6, A-7	0	100	100	95-100	85-100	30-50	11-20
Nimbro	7-60	Stratified loam to clay loam.	CL	A-6, A-7	0	90-100	90-100	80-100	70-95	30-45	11-20

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Nc	0-7	Silty clay loam	ML, CL	A-6, A-7	0	100	100	95-100	85-100	30-50	11-20
Nimbro	7-60	Stratified loam to silty clay loam.	CL	A-6, A-7	0	90-100	90-100	80-100	70-95	30-45	11-20
OaF	0-2	Silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
Okaton	2-14	Clay, silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	14-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	---	---
ObE*:											
Okaton	0-2	Silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	2-14	Clay, silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	14-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	---	---
Lakoma	0-5	Silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	25-50
	5-26	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	85-100	55-85	25-50
	26-36	Silty clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	55-85	25-50
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OkE*:											
Okaton	0-2	Silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	2-14	Clay, silty clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	14-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	---	---
Wendte	0-6	Silty clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-50
	6-60	Stratified silty clay loam to clay.	CH, MH	A-7	0	100	100	90-100	70-100	50-80	20-50
Bullcreek	0-3	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	28-60
	3-12	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	12-25	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	25-60	Clay	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60
OlB, OlC, OlD	0-2	Clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	25-45	11-20
Opal	2-26	Clay	CH, MH	A-7	0-2	100	100	90-100	80-100	65-85	30-50
	26-35	Clay	CH, MH	A-7	0-2	100	95-100	90-100	80-100	65-85	30-50
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OpA, OpB, OpC, OpD	0-2	Clay	CH, MH	A-7	0-2	100	100	90-100	80-100	60-80	25-45
Opal	2-26	Clay	CH, MH	A-7	0-2	100	100	90-100	80-100	65-85	30-50
	26-35	Clay	CH, MH	A-7	0-2	100	95-100	90-100	80-100	65-85	30-50
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ot*	0-10	Gravelly loam	CL, SC	A-4, A-6	0-5	80-100	50-75	45-60	35-55	30-40	8-18
Orthents	10-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
PrA, PrB, PrC	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-90	25-55
Promise	5-34	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	34-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
PsA*:											
Promise	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-90	25-55
	5-34	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	34-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
Bullcreek	0-3	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	60-100	28-60
	3-12	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	12-25	Clay	MH, CH	A-7	0	95-100	95-100	90-100	85-100	70-100	35-60
	25-60	Clay	CH	A-7	0	95-100	95-100	90-100	85-100	70-100	40-60

See footnote at end of table.

TABLE 16 --PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ab	0-60	45-60	1.10-1.25	0.01-0.2	0.10-0.14	7.4-8.4	0-0	Very high	0.37	5	4	.5-4
Albaton												
Bb	0-8	10-20	1.25-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-2	Low	0.32	5	4L	1-3
Bigbend	8-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Bf	0-8	10-20	1.25-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-2	Low	0.32	5	4L	1-3
Bigbend	8-60	8-18	1.25-1.60	0.6-2.0	0.16-0.18	7.4-9.0	0-2	Low	0.43			
Bg	0-10	27-35	1.15-1.25	0.2-0.6	0.19-0.22	6.6-8.4	0-2	Moderate	0.32	5	4L	1-3
Bigbend	10-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Bh	0-8	10-18	1.25-1.40	0.6-2.0	0.15-0.18	6.6-8.4	0-2	Low	0.32	5	3	1-3
Bigbend	8-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Bi*:												
Bigbend	0-8	10-18	1.25-1.40	0.6-2.0	0.15-0.18	6.6-8.4	0-2	Low	0.32	5	3	1-3
	8-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Inavale	0-4	2-10	1.50-1.60	6.0-20	0.10-0.12	5.6-7.8	0-0	Low	0.17	5	2	.5-1
	4-8	3-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	0-0	Low	0.17			
	8-60	3-10	1.50-1.60	6.0-20	0.05-0.11	6.6-8.4	0-0	Low	0.15			
Bu	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
Bullcreek	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Bx*:												
Bullcreek	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Slickspots	0-40	27-40	1.30-1.40	0.06-0.2	0.14-0.16	8.5-9.0	>16	Moderate	0.37	2	6	0-1
	40-60	---	---	0.01-0.2	---	---	---	---	---			
CpA	0-1	15-25	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Low	0.37	2	6	1-2
Capa	1-15	60-70	1.25-1.40	0.01-0.06	0.10-0.14	6.6-8.4	4-16	Very high	0.37			
	15-60	45-65	1.25-1.45	0.01-0.06	0.08-0.12	7.9-8.4	4-16	Very high	0.37			
Hb*:												
Herdcamp	0-6	40-55	1.15-1.25	0.06-0.2	0.13-0.18	7.4-8.4	2-4	Very high	0.28	5	4	3-5
	6-60	37-55	1.15-1.40	0.06-0.2	0.08-0.19	7.4-8.4	2-8	Very high	0.28			
Bullcreek	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Hg	0-8	15-26	1.20-1.30	0.6-2.0	0.19-0.22	7.4-8.4	0-2	Low	0.37	5	4L	1-3
Hilmoe	8-38	35-60	1.20-1.35	0.06-0.2	0.17-0.20	7.4-8.4	0-2	High	0.37			
	38-60	20-30	1.30-1.45	0.2-2.0	0.16-0.20	7.4-8.4	0-4	Moderate	0.28			
Hm	0-7	40-50	1.15-1.25	0.06-0.2	0.19-0.22	7.4-8.4	0-2	High	0.28	5	4	2-4
Hilmoe	7-30	35-60	1.20-1.35	0.06-0.2	0.17-0.20	7.4-8.4	0-2	High	0.37			
	30-60	20-30	1.30-1.45	0.2-2.0	0.16-0.20	7.4-8.4	0-4	Moderate	0.28			

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SvE*:											
Vivian	0-4	Gravelly loam	CL, SC	A-4, A-6	0-5	80-100	50-75	45-60	35-55	30-40	8-18
	4-50	Very gravelly loam, extremely gravelly loam, very gravelly fine sandy loam.	GC, GP-GC	A-2, A-4, A-6	0-5	40-60	20-50	15-50	10-50	30-40	8-18
	50-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	25-55
Wc	0-6	Silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-50
Wendte	6-60	Stratified silty clay loam to clay.	CH, MH	A-7	0	100	100	90-100	70-100	50-80	20-50
Wd	0-6	Silty clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-50
Wendte	6-60	Stratified silty clay loam to clay.	CH, MH	A-7	0	100	100	90-100	70-100	50-80	20-50
Wt	0-12	Silty clay	CH, MH	A-7	0	100	100	95-100	90-100	50-80	20-50
Witten	12-32	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	60-85	25-50
	32-60	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	60-80	25-45

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16 --PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ab	0-60	45-60	1.10-1.25	0.01-0.2	0.10-0.14	7.4-8.4	0-0	Very high	0.37	5	4	.5-4
Albaton												
Bb	0-8	10-20	1.25-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-2	Low	0.32	5	4L	1-3
Bigbend	8-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Bf	0-8	10-20	1.25-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-2	Low	0.32	5	4L	1-3
Bigbend	8-60	8-18	1.25-1.60	0.6-2.0	0.16-0.18	7.4-9.0	0-2	Low	0.43			
Bg	0-10	27-35	1.15-1.25	0.2-0.6	0.19-0.22	6.6-8.4	0-2	Moderate	0.32	5	4L	1-3
Bigbend	10-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Bh	0-8	10-18	1.25-1.40	0.6-2.0	0.15-0.18	6.6-8.4	0-2	Low	0.32	5	3	1-3
Bigbend	8-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Bi*:												
Bigbend	0-8	10-18	1.25-1.40	0.6-2.0	0.15-0.18	6.6-8.4	0-2	Low	0.32	5	3	1-3
	8-60	8-18	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	0-2	Low	0.43			
Inavale	0-4	2-10	1.50-1.60	6.0-20	0.10-0.12	5.6-7.8	0-0	Low	0.17	5	2	.5-1
	4-8	3-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	0-0	Low	0.17			
	8-60	3-10	1.50-1.60	6.0-20	0.05-0.11	6.6-8.4	0-0	Low	0.15			
Bu	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
Bullcreek	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Bx*:												
Bullcreek	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Slickspots	0-40	27-40	1.30-1.40	0.06-0.2	0.14-0.16	8.5-9.0	>16	Moderate	0.37	2	6	0-1
	40-60	---	---	0.01-0.2	---	---	---	---	---			
CpA	0-1	15-25	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Low	0.37	2	6	1-2
Capa	1-15	60-70	1.25-1.40	0.01-0.06	0.10-0.14	6.6-8.4	4-16	Very high	0.37			
	15-60	45-65	1.25-1.45	0.01-0.06	0.08-0.12	7.9-8.4	4-16	Very high	0.37			
Hb*:												
Herdcamp	0-6	40-55	1.15-1.25	0.06-0.2	0.13-0.18	7.4-8.4	2-4	Very high	0.28	5	4	3-5
	6-60	37-55	1.15-1.40	0.06-0.2	0.08-0.19	7.4-8.4	2-8	Very high	0.28			
Bullcreek	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Hg	0-8	15-26	1.20-1.30	0.6-2.0	0.19-0.22	7.4-8.4	0-2	Low	0.37	5	4L	1-3
Hilmoe	8-38	35-60	1.20-1.35	0.06-0.2	0.17-0.20	7.4-8.4	0-2	High	0.37			
	38-60	20-30	1.30-1.45	0.2-2.0	0.16-0.20	7.4-8.4	0-4	Moderate	0.28			
Hm	0-7	40-50	1.15-1.25	0.06-0.2	0.19-0.22	7.4-8.4	0-2	High	0.28	5	4	2-4
Hilmoe	7-30	35-60	1.20-1.35	0.06-0.2	0.17-0.20	7.4-8.4	0-2	High	0.37			
	30-60	20-30	1.30-1.45	0.2-2.0	0.16-0.20	7.4-8.4	0-4	Moderate	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Hn*:												
Hilmoe	0-7	40-50	1.15-1.25	0.06-0.2	0.19-0.22	7.4-8.4	0-2	High	0.28	5	4	2-4
	7-30	35-60	1.20-1.35	0.06-0.2	0.17-0.20	7.4-8.4	0-2	High	0.37			
	30-60	20-30	1.30-1.45	0.2-2.0	0.16-0.20	7.4-8.4	0-4	Moderate	0.28			
Inavale	0-4	2-10	1.50-1.60	6.0-20	0.10-0.12	5.6-7.8	0-0	Low	0.17	5	2	.5-1
	4-8	3-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	0-0	Low	0.17			
	8-60	3-10	1.50-1.60	6.0-20	0.05-0.11	6.6-8.4	0-0	Low	0.15			
Ho	0-4	22-26	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Low	0.37	2	6	2-4
Hoven	4-8	35-60	1.15-1.30	0.01-0.06	0.10-0.19	6.1-7.8	4-16	High	0.37			
	8-23	35-60	1.15-1.30	0.01-0.06	0.10-0.19	6.6-8.4	4-16	High	0.37			
	23-60	35-60	1.30-1.50	0.01-0.2	0.08-0.17	7.4-9.0	4-16	High	0.37			
In	0-4	2-10	1.50-1.60	6.0-20	0.10-0.12	5.6-7.8	0-0	Low	0.17	5	2	.5-1
Inavale	4-8	3-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	0-0	Low	0.17			
	8-60	3-10	1.50-1.60	6.0-20	0.05-0.11	6.6-8.4	0-0	Low	0.15			
KeA, KeB, KeC, KeD	0-6	27-30	1.25-1.35	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	5	6	2-4
Kirley	6-18	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.1-7.8	0-2	High	0.32			
	18-25	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.6-8.4	0-2	High	0.32			
	25-40	27-50	1.25-1.40	0.2-2.0	0.11-0.18	7.4-8.4	0-2	High	0.37			
	40-60	25-40	1.25-1.40	0.2-2.0	0.14-0.17	7.4-8.4	0-2	Moderate	0.37			
KmB*:												
Kirley	0-6	27-30	1.25-1.35	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	5	6	2-4
	6-18	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.1-7.8	0-2	High	0.32			
	18-25	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.6-8.4	0-2	High	0.32			
	25-40	27-50	1.25-1.40	0.2-2.0	0.11-0.18	7.4-8.4	0-2	High	0.37			
	40-60	25-40	1.25-1.40	0.2-2.0	0.14-0.17	7.4-8.4	0-2	Moderate	0.37			
Mosher	0-6	18-26	1.10-1.30	0.6-2.0	0.18-0.22	5.6-7.8	0-2	Low	0.37	2	6	1-3
	6-25	35-60	1.30-1.50	0.01-0.06	0.08-0.14	6.6-9.0	2-4	High	0.32			
	25-60	27-40	1.20-1.45	0.06-0.2	0.08-0.14	7.4-9.0	4-16	High	0.37			
KnB*, KnC*, KnD*:												
Kirley	0-6	27-30	1.25-1.35	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	5	6	2-4
	6-18	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.1-7.8	0-2	High	0.32			
	18-25	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.6-8.4	0-2	High	0.32			
	25-40	27-50	1.25-1.40	0.2-2.0	0.11-0.18	7.4-8.4	0-2	High	0.37			
	40-60	25-40	1.25-1.40	0.2-2.0	0.14-0.17	7.4-8.4	0-2	Moderate	0.37			
Vivian	0-4	18-26	1.35-1.60	2.0-6.0	0.10-0.12	7.4-8.4	0-2	Low	0.24	4	4L	.5-1
	4-50	18-26	1.45-1.70	2.0-6.0	0.08-0.10	7.4-8.4	0-2	Low	0.24			
	50-60	---	---	0.01-0.2		7.4-8.4	---	---	---			
Ko, Kp	0-12	45-60	1.20-1.30	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
Kolls	12-23	60-70	1.20-1.30	0.01-0.06	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	23-60	60-70	1.35-1.50	0.01-0.06	0.08-0.12	7.4-9.0	0-2	Very high	0.37			
LaB, LaC, LaD	0-5	45-60	1.05-1.15	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37	3	4	1-3
Lakoma	5-26	45-60	1.00-1.25	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	26-36	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	36-60	---	---	0.01-0.06	---	---	---	---	---			
LkC*:												
Lakoma	0-5	45-60	1.05-1.15	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37	3	4	1-3
	5-26	45-60	1.00-1.25	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	26-36	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	36-60	---	---	0.01-0.06	---	---	---	---	---			

See footnote at end of table.

TABLE 16 --PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
LkC*:												
Kirley	0-6	27-30	1.25-1.35	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	5	6	2-4
	6-18	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.1-7.8	0-2	High	0.32			
	18-25	35-50	1.20-1.35	0.06-0.6	0.11-0.19	6.6-8.4	0-2	High	0.32			
	25-40	27-50	1.25-1.40	0.2-2.0	0.11-0.18	7.4-8.4	0-2	High	0.37			
	40-60	25-40	1.25-1.40	0.2-2.0	0.14-0.17	7.4-8.4	0-2	Moderate	0.37			
LvE*:												
Lakoma	0-5	45-60	1.05-1.15	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37	3	4	1-3
	5-26	45-60	1.00-1.25	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	26-36	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	36-60	---	---	0.01-0.06	---	---	---					
Vivian	0-4	18-26	1.35-1.60	2.0-6.0	0.10-0.12	7.4-8.4	0-2	Low	0.24	4	4L	.5-1
	4-50	18-26	1.45-1.70	2.0-6.0	0.08-0.10	7.4-8.4	0-2	Low	0.24			
	50-60	---	---	0.01-0.2	---	---	---					
MlA, MlB, MlC	0-9	37-40	1.15-1.30	0.06-0.2	0.13-0.19	6.6-7.8	0-2	High	0.37	5	4	2-4
Millboro	9-18	45-60	1.15-1.30	0.06-0.2	0.10-0.16	6.6-7.8	0-2	Very high	0.37			
	18-60	45-60	1.25-1.40	0.06-0.2	0.10-0.16	7.4-8.4	2-4	Very high	0.37			
Mo	0-6	18-26	1.10-1.30	0.6-2.0	0.18-0.22	5.6-7.8	0-2	Low	0.37	2	6	1-3
Mosher	6-25	35-60	1.30-1.50	0.01-0.06	0.08-0.14	6.6-9.0	2-4	High	0.32			
	25-60	27-40	1.20-1.45	0.06-0.2	0.08-0.14	7.4-9.0	4-16	High	0.37			
Mp*:												
Mosher	0-6	18-26	1.10-1.30	0.6-2.0	0.18-0.22	5.6-7.8	0-2	Low	0.37	2	6	1-3
	6-25	35-60	1.30-1.50	0.01-0.06	0.08-0.14	6.6-9.0	2-4	High	0.32			
	25-60	27-40	1.20-1.45	0.06-0.2	0.08-0.14	7.4-9.0	4-16	High	0.37			
Capa	0-1	15-25	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Low	0.37	2	6	1-2
	1-15	60-70	1.25-1.40	0.01-0.06	0.10-0.14	6.6-8.4	4-16	Very high	0.37			
	15-60	45-65	1.25-1.45	0.01-0.06	0.08-0.12	7.9-8.4	4-16	Very high	0.37			
Nb, Nc	0-7	27-35	1.15-1.25	0.6-2.0	0.19-0.22	7.4-8.4	0-2	Moderate	0.32	5	4L	2-4
Nimbro	7-60	20-35	1.20-1.40	0.6-2.0	0.16-0.20	7.4-8.4	0-2	Moderate	0.28			
OaF	0-2	45-60	1.05-1.25	0.06-0.2	0.11-0.16	7.4-8.4	0-2	Very high	0.37	2	4	1-2
Okaton	2-14	45-60	1.10-1.25	0.06-0.2	0.11-0.16	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.06	---	---	---					
ObE*:												
Okaton	0-2	45-60	1.05-1.25	0.06-0.2	0.11-0.16	7.4-8.4	0-2	Very high	0.37	2	4	1-2
	2-14	45-60	1.10-1.25	0.06-0.2	0.11-0.16	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.06	---	---	---					
Lakoma	0-5	45-60	1.05-1.15	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37	3	4	1-3
	5-26	45-60	1.00-1.25	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	26-36	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	36-60	---	---	0.01-0.06	---	---	---					
OkE*:												
Okaton	0-2	45-60	1.05-1.25	0.06-0.2	0.11-0.16	7.4-8.4	0-2	Very high	0.37	2	4	1-2
	2-14	45-60	1.10-1.25	0.06-0.2	0.11-0.16	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.06	---	---	---					
Wendte	0-6	40-60	1.15-1.25	0.06-0.2	0.13-0.18	7.4-8.4	0-2	Very high	0.37	5	4	3-5
	6-60	45-55	1.20-1.40	0.06-0.2	0.11-0.17	7.4-8.4	0-2	Very high	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
OkE*:												
Bullcreek--------	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
OlB, OlC, OlD-----	0-2	27-40	1.25-1.35	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	3	6	2-4
Opal	2-26	50-60	1.20-1.30	0.01-0.06	0.08-0.14	6.6-8.4	0-2	Very high	0.37			
	26-35	50-60	1.20-1.30	0.01-0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	35-60	---	---	0.01-0.06	---	---	---	----------	----			
OpA, OpB, OpC,												
OpD----------	0-2	50-60	1.20-1.30	0.01-0.06	0.10-0.14	6.6-7.8	0-2	Very high	0.37	3	4	2-4
Opal	2-26	50-60	1.20-1.30	0.01-0.06	0.08-0.14	6.6-8.4	0-2	Very high	0.37			
	26-35	50-60	1.20-1.30	0.01-0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	35-60	---	---	0.01-0.06	---	---	---	----------	----			
Ot*----------	0-10	18-40	1.35-1.60	2.0-6.0	0.10-0.12	7.4-8.4	0-2	Low-------	0.24	2	4L	.5-2
Orthents	10-60	---	---	0.01-0.2	---	---	---	----------	----			
PrA, PrB, PrC-----	0-5	50-60	1.10-1.25	0.01-0.2	0.10-0.14	6.1-7.8	0-2	Very high	0.37	5	4	2-4
Promise	5-34	60-65	1.10-1.25	0.01-0.2	0.08-0.14	7.4-9.0	0-2	Very high	0.37			
	34-60	50-65	1.10-1.25	0.01-0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
PsA*:												
Promise----------	0-5	50-60	1.10-1.25	0.01-0.2	0.10-0.14	6.1-7.8	0-2	Very high	0.37	5	4	2-4
	5-34	60-65	1.10-1.25	0.01-0.2	0.08-0.14	7.4-9.0	0-2	Very high	0.37			
	34-60	50-65	1.10-1.25	0.01-0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
Bullcreek--------	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
PtA*:												
Promise----------	0-5	50-60	1.10-1.25	0.01-0.2	0.10-0.14	6.1-7.8	0-2	Very high	0.37	5	4	2-4
	5-34	60-65	1.10-1.25	0.01-0.2	0.08-0.14	7.4-9.0	0-2	Very high	0.37			
	34-60	50-65	1.10-1.25	0.01-0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
Bullcreek--------	0-3	55-65	1.10-1.20	0.01-0.06	0.10-0.14	6.6-8.4	0-2	Very high	0.37	5	4	2-4
	3-12	60-70	1.10-1.25	0.01-0.06	0.10-0.14	7.4-9.0	0-4	Very high	0.37			
	12-25	60-70	1.15-1.30	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
	25-60	60-70	1.25-1.40	0.01-0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37			
Kolls----------	0-9	45-60	1.20-1.30	0.01-0.06	0.10-0.14	7.4-8.4	0-2	Very high	0.37	5	4	2-4
	9-31	60-70	1.20-1.30	0.01-0.06	0.08-0.12	7.4-8.4	0-2	Very high	0.37			
	31-60	60-70	1.35-1.50	0.01-0.06	0.08-0.12	7.4-9.0	0-2	Very high	0.37			
Pu*:												
Promise----------	0-5	50-60	1.10-1.25	0.01-0.2	0.10-0.14	6.1-7.8	0-2	Very high	0.37	5	4	2-4
	5-34	60-65	1.10-1.25	0.01-0.2	0.08-0.14	7.4-9.0	0-2	Very high	0.37			
	34-60	50-65	1.10-1.25	0.01-0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
Capa----------	0-1	15-25	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Low-------	0.37	2	6	1-2
	1-15	60-70	1.25-1.40	0.01-0.06	0.10-0.14	6.6-8.4	4-16	Very high	0.37			
	15-60	45-65	1.25-1.45	0.01-0.06	0.08-0.12	7.9-8.4	4-16	Very high	0.37			
ReA, ReB, ReC-----	0-7	22-26	1.15-1.30	0.6-2.0	0.18-0.22	6.1-7.3	0-2	Low-------	0.28	5	6	2-4
Ree	7-23	27-35	1.20-1.35	0.6-2.0	0.17-0.22	6.6-8.4	0-2	Moderate	0.28			
	23-60	15-35	1.30-1.50	0.6-2.0	0.09-0.20	7.4-8.4	0-2	Low-------	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
SaE	0-3	55-65	1.10-1.20	0.06-0.2	0.08-0.12	6.6-8.4	0-2	Very high	0.37	2	4	1-2
Sansarc	3-14	55-65	1.10-1.20	0.06-0.2	0.06-0.12	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.2	---	---	0-2	---	---			
SoE*:												
Sansarc	0-3	55-65	1.10-1.20	0.06-0.2	0.08-0.12	6.6-8.4	0-2	Very high	0.37	2	4	1-2
	3-14	55-65	1.10-1.20	0.06-0.2	0.06-0.12	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.2	---	---	0-2	---	---			
Opal	0-2	50-60	1.20-1.30	0.01-0.06	0.10-0.14	6.6-7.8	0-2	Very high	0.37	3	4	2-4
	2-26	50-60	1.20-1.30	0.01-0.06	0.08-0.14	6.6-8.4	0-2	Very high	0.37			
	26-35	50-60	1.20-1.30	0.01-0.06	0.08-0.12	6.6-8.4	2-4	Very high	0.37			
	35-60	---	---	0.01-0.06	---	---	---	---	---			
SrE*:												
Sansarc	0-3	55-65	1.10-1.20	0.06-0.2	0.08-0.12	6.6-8.4	0-2	Very high	0.37	2	4	1-2
	3-14	55-65	1.10-1.20	0.06-0.2	0.06-0.12	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.2	---	---	0-2	---	---			
Rock outcrop	0-60	---	---	0.01-0.6	---	---	---	---	---	---	---	---
SvE*:												
Sansarc	0-3	55-65	1.10-1.20	0.06-0.2	0.08-0.12	6.6-8.4	0-2	Very high	0.37	2	4	1-2
	3-14	55-65	1.10-1.20	0.06-0.2	0.06-0.12	7.4-8.4	0-2	Very high	0.37			
	14-60	---	---	0.01-0.2	---	7.4-8.4	0-2	---	---			
Vivian	0-4	18-26	1.35-1.60	2.0-6.0	0.10-0.12	7.4-8.4	0-2	Low	0.24	4	4L	.5-1
	4-50	18-26	1.45-1.70	2.0-6.0	0.08-0.10	7.4-8.4	0-2	Low	0.24			
	50-60	---	---	0.01-0.2	---	---	---	---	---			
Wc	0-6	40-60	1.15-1.25	0.06-0.2	0.13-0.18	7.4-8.4	0-2	Very high	0.37	5	4	2-4
Wendte	6-60	45-55	1.20-1.40	0.06-0.2	0.11-0.17	7.4-8.4	0-2	Very high	0.37			
Wd	0-6	40-60	1.15-1.25	0.06-0.2	0.13-0.18	7.4-8.4	0-2	Very high	0.37	5	4	3-5
Wendte	6-60	45-55	1.20-1.40	0.06-0.2	0.11-0.17	7.4-8.4	0-2	Very high	0.37			
Wt	0-12	40-50	1.10-1.20	0.06-0.2	0.10-0.14	6.6-7.8	0-2	Very high	0.37	5	4	3-5
Witten	12-32	50-60	1.10-1.25	0.06-0.2	0.10-0.14	6.6-7.8	0-2	Very high	0.37			
	32-60	50-60	1.15-1.35	0.06-0.2	0.08-0.12	7.4-8.4	2-4	Very high	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ab---------- Albaton	D	Frequent----	Brief-----	Mar-Oct	>6.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
Bb---------- Bigbend	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Bf---------- Bigbend	B	Frequent----	Brief-----	Mar-Oct	>6.0	---	---	>60	---	Moderate	High-----	Low.
Bg, Bh---------- Bigbend	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Bi*:												
Bigbend----------	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Inavale----------	A	Rare--------	---		>6.0	---	---	>60	---	Low------	Moderate	Low.
Bu---------- Bullcreek	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Bx*:												
Bullcreek--------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Slickspots-------	D	None--------	---	---	>6.0	---	---	>60	Soft	High-----	High-----	Moderate.
CpA---------- Capa	D	None--------	---	---	3.5-5.0	Perched	Jan-Jun	>60	---	Low------	High-----	Moderate.
Hb*:												
Herdcamp---------	D	Frequent----	Long------	Mar-Nov	0-1.0	Apparent	Apr-Oct	>60	---	High-----	High-----	Moderate.
Bullcreek--------	D	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Hg, Hm---------- Hilmoe	C	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Hn*:												
Hilmoe-----------	C	Occasional	Brief-----	Mar-Oct	>6.0	---	---	>60	---	Low------	High-----	High.
Inavale----------	A	Occasional	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low------	Moderate	Low.
Ho---------- Hoven	D	None--------	---	---	+1-1.5	Perched	Mar-Jul	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
In---------- Inavale	A	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
KeA, KeB, KeC, KeD---------- Kirley	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
KmB*:												
Kirley----------	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
Mosher----------	D	None---------	---	---	3.0-5.0	Perched	Oct-Jun	>60	---	Moderate	High------	Moderate.
KnB*, KnC*, KnD*:												
Kirley----------	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low
Vivian----------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Low-------	High------	Low.
Ko---------- Kolls	D	None---------	---	---	0-1.5	Perched	Apr-Jun	>60	---	Moderate	High------	Moderate.
Kp---------- Kolls	D	None---------	---	---	+1-1.0	Perched	Apr-Jun	>60	---	Moderate	High------	Moderate.
LaB, LaC, LaD----- Lakoma	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
LkC*:												
Lakoma----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Kirley----------	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
LvE*:												
Lakoma----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Vivian----------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Low-------	High------	Low.
M1A, M1B, M1C----- Millboro	D	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Mo---------- Mosher	D	None---------	---	---	3.0-5.0	Perched	Oct-Jun	>60	---	Moderate	High------	Moderate.
Mp*:												
Mosher----------	D	None---------	---	---	3.0-5.0	Perched	Oct-Jun	>60	---	Moderate	High------	Moderate.
Capa----------	D	None---------	---	---	3.5-5.0	Perched	Jan-Jun	>60	---	Low-------	High------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Nb---------- Nimbro	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Nc---------- Nimbro	B	Frequent----	Brief-----	Apr-Oct	3.5-5.0	Apparent	Mar-May	>60	---	Moderate	High-----	Low.
OaF---------- Okaton	D	None---------	---	---	>6.0	---	---	8-20	Soft	Low------	High-----	High.
ObE*: Okaton----------	D	None---------	---	---	>6.0	---	---	8-20	Soft	Low------	High-----	High.
Lakoma----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
OkE*: Okaton----------	D	None---------	---	---	>6.0	---	---	8-20	Soft	Low------	High-----	High.
Wendte----------	D	Occasional	Brief-----	Apr-Oct	3.5-5.0	Apparent	Mar-Jun	>60	---	Low------	High-----	Low.
Bullcreek--------	D	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
OlB, OlC, OlD, OpA, OpB, OpC, OpD---------- Opal	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Ot*---------- Orthents	C	None---------	---	---	>6.0	---	---	5-10	Soft	Low------	Low------	Low.
PrA, PrB, PrC----- Promise	D	None---------	---	---	>6.0	---	---	>40	---	Low------	High-----	Low.
PsA*: Promise----------	D	None---------	---	---	>6.0	---	---	>40	---	Low------	High-----	Low.
Bullcreek--------	D	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
PtA*: Promise----------	D	None---------	---	---	>6.0	---	---	>40	---	Low------	High-----	Low.
Bullcreek--------	D	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Kolls------------	D	None---------	---	---	0-1.5	Perched	Apr-Jun	>60	---	Moderate	High-----	Moderate.
Pu*: Promise----------	D	None---------	---	---	>6.0	---	---	>40	---	Low------	High-----	Low.
Capa------------	D	None---------	---	---	3.5-5.0	Perched	Jan-Jun	>60	---	Low------	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
ReA, ReB, ReC----- Ree	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
SaE---------- Sansarc	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
SoE*:												
Sansarc----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
Opal----------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
SrE*:												
Sansarc----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
Rock outcrop-----	D	None--------	---	---	>6.0	---	---	0-1	Soft	Low------	Moderate	Low.
SvE*:												
Sansarc----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
Vivian----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	High-----	Low.
Wc---------- Wendte	D	Rare--------	---	---	3.5-5.0	Apparent	Mar-Jun	>60	---	Low------	High-----	Low.
Wd---------- Wendte	D	Occasional	Brief-----	Apr-Oct	3.5-5.0	Apparent	Mar-Jun	>60	---	Low------	High-----	Low.
Wt---------- Witten	D	None--------	---	---	3.5-5.0	Perched	Mar-May	>60	---	Moderate	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Albaton	Very fine, smectitic (calcareous), mesic Vertic Fluvaquents
Bigbend	Coarse-silty, mixed (calcareous), mesic Typic Ustifluvents
Bullcreek	Very fine, smectitic, mesic Typic Haplusterts
Capa	Very fine, smectitic, mesic Vertic Natrustolls
Herdcamp	Fine, smectitic (calcareous), mesic Vertic Endoaquolls
*Hilmoe	Clayey over loamy, smectitic, mesic Fluventic Haplustolls
Hoven	Fine, smectitic, mesic Vertic Natraquolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Kirley	Fine, smectitic, mesic Vertic Argiustolls
Kolls	Very fine, smectitic, mesic Typic Epiaquerts
Lakoma	Fine, smectitic, mesic Typic Ustochrepts
Millboro	Fine, smectitic, mesic Typic Haplusterts
Mosher	Fine, smectitic, mesic Vertic Natrustolls
Nimbro	Fine-loamy, mixed (calcareous), mesic Mollic Ustifluvents
Okaton	Clayey, smectitic (calcareous), mesic, shallow Typic Ustorthents
Opal	Fine, smectitic, mesic Leptic Udic Haplusterts
Orthents	Orthents
Promise	Very fine, smectitic, mesic Typic Haplusterts
Ree	Fine-loamy, mixed, mesic Typic Argiustolls
Sansarc	Clayey, smectitic (calcareous), mesic, shallow Typic Ustorthents
Vivian	Loamy-skeletal, mixed (calcareous), mesic Typic Ustorthents
Wendte	Fine, smectitic (calcareous), mesic Vertic Ustifluvents
Witten	Fine, smectitic, mesic Vertic Argiustolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil is not assigned to the interpretive group)

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
Ab—Albaton	IVw-1	Clayey Overflow	10	B2
Bb—Bigbend	IIc-1	Loamy Terrace	1	F
Bf—Bigbend	VIw-1	Loamy Overflow	1	F
Bg—Bigbend	IIc-1	Loamy Terrace	1	F
Bh—Bigbend	IIe-1	Loamy Terrace	1	F
Bi:				
Bigbend	IIe-1	Loamy Terrace	1	F
Inavale	IVe-9	Sands	7	H
Bu—Bullcreek	VIs-5	Dense Clay	10	NS
Bx:				
Bullcreek	VIs-5	Dense Clay	10	NS
Slickspots	VIIIs-3	---	10	NS
CpA—Capa	VIs-1	Thin Claypan	10	NS
Hb:				
Herdcamp	VIw-2	Wetland	10	B1
Bullcreek	VIs-5	Dense Clay	10	NS
Hg—Hilmoe	IIs-1	Loamy Overflow	4	E
Hm—Hilmoe	IIIs-1	Clayey Overflow	4	I
Hn:				
Hilmoe	IIIs-3	Clayey Overflow	4	I
Inavale	IVe-9	Sands	7	H
Ho—Hoven	VIs-1	Closed Depression	10	B2
In—Inavale	IVe-9	Sands	7	H
KeA—Kirley	IIc-2	Clayey	3	F
KeB—Kirley	IIe-1	Clayey	3	F
KeC—Kirley	IIIe-1	Clayey	3	F

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
KeD---------- Kirley	IVe-1	Clayey----------	3	F
KmB:				
Kirley----------	IIe-1	Clayey----------	3	F
Mosher----------	IVs-2	Claypan----------	9	C
KnB:				
Kirley----------	IIe-1	Clayey----------	3	F
Vivian----------	IVe-6	Thin Upland--------	8	D2
KnC:				
Kirley----------	IIIe-1	Clayey----------	3	F
Vivian----------	VIe-5	Thin Upland--------	8	D2
KnD:				
Kirley----------	IVe-1	Clayey----------	3	F
Vivian----------	VIe-5	Thin Upland--------	10	NS
Ko---------- Kolls	Vw-4	Closed Depression--	10	B2
Kp---------- Kolls	VIIIw-1	Shallow Marsh------	10	NS
LaB---------- Lakoma	IIIe-4	Thin Upland--------	8	I
LaC---------- Lakoma	IVe-4	Thin Upland--------	8	I
LaD---------- Lakoma	VIe-4	Thin Upland--------	10	I
LkC:				
Lakoma----------	IVe-4	Thin Upland--------	8	I
Kirley----------	IIe-1	Clayey----------	3	F
LvE:				
Lakoma----------	VIe-4	Thin Upland--------	10	I
Vivian----------	VIe-5	Thin Upland--------	10	NS
MlA---------- Millboro	IIs-2	Clayey----------	4	I
MlB---------- Millboro	IIIe-4	Clayey----------	4	I
MlC---------- Millboro	IVe-4	Clayey----------	4	NS
Mo---------- Mosher	IVs-2	Claypan----------	9	C
Mp:				
Mosher----------	IVs-2	Claypan----------	9	C
Capa----------	VIs-1	Thin Claypan-------	10	NS
Nb---------- Nimbro	IIc-1	Loamy Terrace------	1	F

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
Nc---------- Nimbro	VIw-1	Loamy Overflow-----	1	NS
OaF---------- Okaton	VIIe-8	Shallow----------	10	NS
ObE:				
Okaton----------	VIIe-8	Shallow----------	10	NS
Lakoma----------	VIe-4	Thin Upland--------	10	NS
OkE:				
Okaton----------	VIIe-8	Shallow----------	10	NS
Wendte----------	VIw-1	Clayey Overflow----	4	NS
Bullcreek---------	VIs-5	Dense Clay---------	10	NS
OlB---------- Opal	IIIe-4	Clayey----------	4	I
OlC---------- Opal	IVe-4	Clayey----------	4	I
OlD---------- Opal	VIe-4	Clayey----------	4	I
OpA---------- Opal	IIIe-3	Clayey----------	4	I
OpB---------- Opal	IIIe-4	Clayey----------	4	I
OpC---------- Opal	IVe-4	Clayey----------	4	I
OpD---------- Opal	VIe-4	Clayey----------	4	I
Ot---------- Orthents	VIIIs-1	---	10	NS
PrA---------- Promise	IIIs-3	Clayey----------	4	I
PrB---------- Promise	IIIe-4	Clayey----------	4	I
PrC---------- Promise	IVe-4	Clayey----------	4	I
PsA:				
Promise----------	IIIs-3	Clayey----------	4	I
Bullcreek---------	VIs-5	Dense Clay---------	10	NS
PtA:				
Promise----------	IIIs-3	Clayey----------	4	I
Bullcreek---------	VIs-5	Dense Clay---------	10	NS
Kolls----------	Vw-4	Closed Depression--	10	B2
Pu:				
Promise----------	IIIs-3	Clayey----------	4	I
Capa----------	VIs-1	Thin Claypan-------	10	NS
ReA---------- Ree	IIc-2	Silty----------	3	F

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
ReB---------- Ree	IIe-1	Silty----------	3	F
ReC---------- Ree	IIIe-1	Silty----------	3	F
SaE---------- Sansarc	VIIe-8	Shallow Clay-------	10	NS
SoE:				
Sansarc------	VIIe-8	Shallow Clay-------	10	NS
Opal----------	VIe-4	Clayey----------	10	NS
SrE:				
Sansarc------	VIIe-8	Shallow Clay-------	10	NS
Rock outcrop------	VIIIs-1	---	10	NS
SvE:				
Sansarc------	VIIe-8	Shallow Clay-------	10	NS
Vivian------	VIe-5	Thin Upland--------	10	NS
Wc---------- Wendte	IIIs-3	Clayey Overflow----	4	I
Wd---------- Wendte	VIw-1	Clayey Overflow----	4	NS
Wt---------- Witten	IIIs-3	Clayey Overflow----	4	I

* Soils in windbreak suitability group 10 are unsuited to windbreaks.

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